

Inputs/Outputs		
Digital Output	Pulses/Unit [1] 	<p>The Pulses/Unit parameter lets you set how many pulses per unit of measure will be transmitted to remote applications. For example, assuming the unit of measure is gallons:</p> <ul style="list-style-type: none"> • Setting the Pulses/Unit to 1 will transmit 1 pulse every gallon • Setting the Pulses/Unit to 0.01 will transmit 1 pulse every 100 gallons <p>You must configure pulses/unit if the function of the selected output is to be forward, reverse or AMR pulse.</p> <p>This parameter must be considered with the Pulse Width and Full Scale Flow parameters. The maximum pulse frequency is 10 kHz. The frequency is correlated with the flow rate. Violation of output frequency limits will generate a configuration error.</p> <p>To change the pulses/unit, follow these steps from the <i>Inputs/Outputs</i> menu:</p> <ol style="list-style-type: none"> 1. Select Digital Output 1 or 2 and press [E] to open the <i>Digital Output</i> menu. 2. From the <i>Digital Output</i> menu select Pulses/Unit, and press [E] to open the <i>Pulses/Unit</i> display. 3. Enter the pulses/unit value. Press [E] to save the new parameter and return to the <i>Digital Output</i> menu.
	Pulse Width [0 ms] 	<p>The Pulse Width parameter establishes the On duration of the transmitted pulse. The configurable range is from 0 to 1000 ms.</p> <ul style="list-style-type: none"> • Non-zero pulse width configuration – the Off duration of the transmitted pulse is dependent on flow rate. The Off duration is to be at least the configured On duration. At full scale flow, the On duration equals the Off duration. The maximum configurable output frequency is limited to 500 Hz. • 0 ms pulse width configuration – the duty cycle of the transmitted pulse is at 50 percent allowing for a maximum configurable output frequency of 10 kHz. <p>This parameter must be considered with the Pulses/Unit and Full Scale Flow parameters. The maximum pulse frequency is 10 kHz. The frequency is correlated with the flow rate. Violation of output frequency limits will generate a configuration error.</p> <p>To change the pulse width, follow these steps from the <i>Inputs/Outputs</i> menu:</p> <ol style="list-style-type: none"> 1. Select Digital Output 1 or 2 and press [E] to open the <i>Digital Output</i> menu. 2. From the <i>Digital Output</i> menu select Pulse Width, and press [E] to open the <i>Pulse Width</i> display. 3. Enter the pulse width value. Press [E] to save the new parameter and return to the <i>Digital Output</i> menu.

Inputs/Outputs		
Digital Output	Preset Amount [0.0] 	<p>Preset amount lets you set the reset value for the associated PS totalizer when the digital input is set to Batch Reset.</p> <p>To change the preset amount, follow these steps from the <i>Inputs/Outputs</i> menu:</p> <ol style="list-style-type: none"> 1. Select Digital Output 1, 2, 3 or 4 and press [E] to open the <i>Digital Output</i> menu. 2. From the <i>Digital Output</i> menu select Preset Amount, and press [E] to open the <i>Preset Amount</i> display. 3. Enter the preset amount value. Press [E] to save the new parameter and return to the <i>Digital Output</i> menu. <p>NOTE: You can only set one Preset Amount. If you set the Preset Amount for Digital Output 1, it will be the same for 2, 3 and 4.</p>
	Set Point Min. [0%] 	<p>This parameter establishes, as a percentage of full scale flow, the threshold at which the output alarm will be activated. Flow rates below the threshold will activate the output alarm.</p> <p>To change the set point minimum, follow these steps from the <i>Inputs/Outputs</i> menu:</p> <ol style="list-style-type: none"> 1. Select Digital Output 1, 2, 3 or 4 and press [E] to open the <i>Digital Output</i> menu. 2. From the <i>Digital Output</i> menu select Set Point Min., and press [E] to open the <i>Set Point Min.</i> display. 3. Enter the set point minimum value. Press [E] to save the new parameter and return to the <i>Digital Output</i> menu.
	Set Point Max. [100%] 	<p>This parameter establishes, as a percentage of full scale flow, the threshold at which the output alarm will be activated. Flow rates above the threshold will activate the output alarm.</p> <p>To change the maximum set point, follow these steps from the <i>Inputs/Outputs</i> menu:</p> <ol style="list-style-type: none"> 1. Select Digital Output 1, 2, 3 or 4 and press [E] to open the <i>Digital Output</i> menu. 2. From the <i>Digital Output</i> menu select Set Point Max., and press [E] to open the <i>Set Point Max.</i> display. 3. Enter the set point maximum value and press [E] to save the new parameter and return to the <i>Digital Output</i> menu.

Inputs/Outputs		
Digital Output	Output Type [1: Normally Open] [2: Normally Open] [3: Normally Open] [4: Normally Closed] 	The Output Type parameter lets you set the output switch to normally open or normally closed. If normally open is selected, the output switch is open (no current) when the output is inactive, and closed (current flows) when the output is active. If normally closed is selected, the output switch is closed (current flows) when the output is inactive, and open (no current) when the output is active. To change the Output Type, follow these steps from the <i>Inputs/Outputs</i> main menu: <ol style="list-style-type: none"> 1. Select Digital Output 1, 2, 3 or 4 and press [E] to open the <i>Digital Output</i> menu. 2. From the <i>Digital Output</i> menu, select Output Type and press [E] to open the <i>Output Type</i> display. 3. Select Normally Open or Normally Closed. 4. Press [E] to save the new parameter and return to the <i>Digital Output</i> menu.
Hardware Type	[3: Open Collector] [4: Open Collector] 	The Hardware Type parameter lets you select the type of hardware used to drive the output signal: either open collector or solid-state relay. To change the Hardware Type, follow these steps from the <i>Inputs/Outputs</i> main menu: <ol style="list-style-type: none"> 1. Select Digital Output 3 or 4 and press [E] to open the <i>Digital Output</i> menu. 2. From the <i>Digital Output</i> menu select Hardware Type, and press [E] to open the <i>Hardware Type</i> display. 3. Select Open Collector or Relay. 4. Press [E] to save the new parameter and return to the <i>Digital Output</i> menu.
Full Scale Frequency	[3: 1000 Hz] 	The Full Scale Frequency parameter establishes the full scale flow output frequency when the flow rate equals the configured full scale flow. To change the Full Scale Frequency, follow these steps from the <i>Inputs/Outputs</i> main menu: <ol style="list-style-type: none"> 1. Select Digital Output 3 and press [E] to open the <i>Digital Output</i> menu. 2. From the <i>Digital Output</i> menu select Full Scale Frequency, and press [E] to open the <i>Full Scale Frequency</i> display. 3. Set the full scale frequency value to the desired setting. 4. Press [E] to save the new parameter and return to the <i>Digital Output</i> menu.

Inputs/Outputs		
Digital Output	Select Function [1: Forward Pulse] [2: Reverse Pulse] [3: Frequency Pulse] [4: Error Alarm] 	<p>Digital Output lets you configure the functional operation of the associated output. The following operations are supported:</p> <ul style="list-style-type: none"> • Reverse Pulse – Generates pulses during reverse flow conditions. • Forward Pulse – Generates pulses during forward flow conditions. • Frequency Output – Generates pulses correlated to the absolute value of the flow rate. • Preset Output – Provides indication when preset batch amount has been realized. • Flow Set Point – Provides indication when flow rate exceeds thresholds defined by flow set points. • 24V DC Supply – Provides constant 24 volts on output (forces output type to normally open). • Error Alarm – Provides indication when meter has error condition. Error conditions include, empty pipe error, full scale flow error, and detector error. • Flow Direction – Provides indication on current flow direction (Inactive = Reverse or No Flow, Active = Forward). • Empty Pipe Alarm – Provides indication when pipe is empty. • ADE – Provides meter information in digital format. See "ADE Interface" on page 50. <p>To change the Function Select, follow these steps from the <i>Inputs/Outputs</i> main menu:</p> <ol style="list-style-type: none"> 1. Select Digital Output 1, 2, 3 or 4 and press [E] to open the <i>Digital Output</i> menu. 2. From the <i>Digital Output</i> menu choose Select Function, and press [E] to open the <i>Select Function</i> display. 3. Select the desired function. 4. Press [E] to save and return to the <i>Digital Output</i> menu.
Flow Simulation [Off] 	<p>Flow Simulation provides output simulation based on a percentage of the full scale flow. Simulation will not accumulate the totalizers. The range of simulation includes –100% to 100% of the full scale flow.</p> <p>The Flow Simulation Parameter lets you set the range of simulation in 10% increments.</p> <p>To change the Flow Simulation, follow these steps from the <i>Inputs/Outputs</i> menu:</p> <ol style="list-style-type: none"> 1. Select Flow Simulation to view the <i>Flow Simulation</i> display. 2. Click [+] to increment the percentage by 10, or click [–] to decrement the percentage by 10. 3. Press [E] to save the displayed setting and return to the <i>Inputs/Outputs</i> menu. 	

Clear Totals	
T1  	The uni-directional totalizer is reset within the menu manager or through remote communications. Clearing T1 also clears the associated rollover counter.
T2  	The uni-directional totalizer is reset within the menu manager, through remote communications or with properly-configured digital input (function = remote reset). Clearing T2 also clears the associated rollover counter.
T+  	The bi-directional forward flow totalizer is reset within the menu manager or through remote communications. Clearing T+ also clears the associated rollover counter.
T-  	The bi-directional reverse flow totalizer is reset within the menu manager or through remote communications. Clearing T- also clears the associated rollover counter.
TN  	The bi-directional net totalizer, when reset, clears both the forward and the reverse flow totalizers (T+ and T-). This is reset within the menu manager or through remote communications. Clearing TN also clears the associated rollover counter.
PS  	The batch totalizer is reset to the configured preset amount value. It is reset within the menu manager, remote communications or through a properly-configured digital input (function = batch reset).
Tpwoff  	The totalizer accumulating meter time without external power is reset with the menu manager or through remote communications.

Communication		
Port A Settings	Interface [MODBUS RTU]  	<p>The Interface parameter lets you configure how the RS232 communication port will be used.</p> <ul style="list-style-type: none"> • MODBUS RTU • Remote menu (RDI – Remote Display Interface) • Primo 3.x • Disable port <p>The remote menu interface will check for display updates once a second. If a change is detected, the display contents will be transmitted in ASCII format over the RS232 communication port. The remote menu interface also allows for menu navigation and control of the meter as if using the external push buttons. Keyboard control characters such as <UP>, <DWN>, and <ENTER> are supported to navigate the menus.</p> <p>The Primo 3.x interface will emulate the legacy Primo 3.x Protocol. This protocol will transmit an ASCII string in the following format every 500 ms: "RATE;0.0000; GPM; TOT1;150.0000; USG ; TOT2;150.0000; USG ;"- For Unidirectional Mode "RATE;0.0000; GPM; TOT+;10.0000; USG ; TOT-;50.0000; USG ;"- For Bidirectional Mode</p> <p>To change the Interface follow these steps from the <i>Port A Settings</i> menu:</p> <ol style="list-style-type: none"> 1. Select Interface to view the <i>Interface</i> display. 2. Select the desired interface. 3. Press [E] to save and return to the <i>Port A Settings</i> menu.

Communication		
Port A Settings	Port Address [1]  S	This parameter establishes the MODBUS RTU address. MODBUS RTU requests will only be processed if the configured port address of the meter matches the request address found in the MODBUS RTU packet. The range of addresses supported by MODBUS RTU is 1...247. MODBUS RTU request packets with an address of 0 imply the packet is to be treated as a broadcast packet. To change the port address, follow these steps from the <i>Port A Settings</i> menu: <ol style="list-style-type: none">1. Select Port Address to view the <i>Port Address</i> display.2. Select the desired port address (1...247).3. Press [E] to save the option and to return to the <i>Port A Settings</i> menu.
	External Port Address [1]  S	For PROFIBUS® use only. This parameter allows configuration of the PROFIBUS DP daughterboard address.
	Baud Rate [9600]  S	The following Baud Rates are supported <ul style="list-style-type: none">• 9600• 19200• 38400 To change the baud rate, follow these steps from the <i>Port A Settings</i> menu: <ol style="list-style-type: none">1. Select Baud Rate to view the <i>Baud Rate</i> display.2. Select one of the following baud rates: 9600, 19200 or 38400.3. Press [E] to save the option and to return to the <i>Port A Settings</i> menu.
	Data Bits [8 bits]  S	The Data Bits parameter configures the port data bits. The following data bits are supported: <ul style="list-style-type: none">• 8 bits• 7 bits• 5 bits To change the data bits, follow these steps from the <i>Port A Settings</i> menu: <ol style="list-style-type: none">1. Select Data Bits to view the <i>Data Bits</i> display.2. Select one of the following: 8 Bits, 7 Bits or 5 Bits.3. Press [E] to save the option and to return to the <i>Port A Settings</i> menu.

Communication																						
Port A Settings	Parity [Even] 	<p>The following Parities are supported</p> <ul style="list-style-type: none"> • Even • Odd • None <p>To change the parity, follow these steps from the <i>Port A Settings</i> menu:</p> <ol style="list-style-type: none"> 1. Select Parity to view the <i>Parity</i> display. 2. Select one of the following: None, Even or Odd. 3. Press [E] to save the option and to return to the <i>Port A Settings</i> menu. 																				
	Stop Bits [1 Stop Bit] 	<p>The Stop Bits parameter configures the port stop bits. The following stop bits are supported:</p> <ul style="list-style-type: none"> • 1 Stop Bit • 2 Stop Bits <p>To change the stop bits, follow these steps from the <i>Port A Settings</i> menu:</p> <ol style="list-style-type: none"> 1. Select Stop Bits to view the <i>Stop Bits</i> display. 2. Select one of the following: 1 Stop Bit, or 2 Stop Bits. 3. Press [E] to save the option and to return to the <i>Port A Settings</i> menu. 																				
Port B Settings	Port Address [1] 	<p>An additional communication port, known as Port B, is used to offer enhanced communications with the meter. This port is located on the 11-pin terminal of the PCB. Enhanced protocols like Hart, Profibus DP or Modbus RTU over RS485 are available. In addition, this communication port has similar configurable properties as port A. Refer to the following user manuals for additional information regarding the enhanced communication capabilities of the M2000.</p> <ul style="list-style-type: none"> • HART® communication protocol. • PROFIBUS DP communication protocol. • MODBUS RTU communication protocol. 																				
Diagnostics	Port Counters [0] 	<p>Port counters are used for diagnostics when configured for MODBUS RTU. These counters are only cleared on power up.</p> <table border="1"> <thead> <tr> <th>Counter</th><th>Description</th></tr> </thead> <tbody> <tr> <td>Pkts Processed</td><td>Number of packets processed by meter.</td></tr> <tr> <td>Broadcast Pkts</td><td>Number of broadcast packets (address = 0) processed by meter.</td></tr> <tr> <td>CRC Errors</td><td>Number of received packets with CRC error; packet is discarded.</td></tr> <tr> <td>Pkts Rcvd</td><td>Number of packets received with an address of the configured port address.</td></tr> <tr> <td>Pkts Sent</td><td>Number of packets transmitted in response to a received packet.</td></tr> <tr> <td>Parity Errors</td><td>Number of characters with parity errors (i.e., received character has a mismatch between the number of 1s and its parity bit); packet is discarded.</td></tr> <tr> <td>Framing Errors</td><td>Number of characters with framing errors (i.e. missing stop bit is not found – indicates that synchronization with the start bit has been lost and that the character is improperly framed); packet is discarded.</td></tr> <tr> <td>Overrun Errors</td><td>Number of characters received that were not processed due to degradation of system performance.</td></tr> <tr> <td>Break Detects</td><td>Number of detections that transmission line is locked (i.e., receive line is low for 10-bit transmissions following a missing stop bit).</td></tr> </tbody> </table>	Counter	Description	Pkts Processed	Number of packets processed by meter.	Broadcast Pkts	Number of broadcast packets (address = 0) processed by meter.	CRC Errors	Number of received packets with CRC error; packet is discarded.	Pkts Rcvd	Number of packets received with an address of the configured port address.	Pkts Sent	Number of packets transmitted in response to a received packet.	Parity Errors	Number of characters with parity errors (i.e., received character has a mismatch between the number of 1s and its parity bit); packet is discarded.	Framing Errors	Number of characters with framing errors (i.e. missing stop bit is not found – indicates that synchronization with the start bit has been lost and that the character is improperly framed); packet is discarded.	Overrun Errors	Number of characters received that were not processed due to degradation of system performance.	Break Detects	Number of detections that transmission line is locked (i.e., receive line is low for 10-bit transmissions following a missing stop bit).
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Advanced Features																																															
Unit Multiplier [Off]	The Unit Multiplier establishes the number of units of measure that have to accumulate before the display totalizers are updated. This is also known as setting the number of "dead" zeroes in the display totalizer. For example:																																														
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10	0 USG	0 USG	10 USG	120 USG	1230 USG																																										
100	0 USG	0 USG	0 USG	100 USG	1200 USG																																										
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	To change the Unit Multiplier, follow these steps from the <i>Advanced</i> menu:																																														
	<ol style="list-style-type: none"> 1. Select Unit Multiplier to view the <i>Unit Multiplier</i> display. 2. Select the desired unit multiplier. 3. Press [E] to save the option and to return to the <i>Advanced</i> menu. 																																														
Backlight Control [Timed Off]	You can set the meter's backlight to: Always On, Always Off and Timed Off. When set to Timed Off, the backlight will automatically turn off after one minute of inactivity (no buttons pressed). Pressing any button will turn the backlight on, but will not immediately navigate the menu.																																														
	To change the backlight control, follow these steps from the <i>Advanced</i> menu:																																														
	<ol style="list-style-type: none"> 1. Select Backlight Control to view the <i>Backlight Control</i> display. 2. Select the desired option. 3. Press [E] to save the option and to return to the <i>Advanced</i> menu. 																																														
Token Copy	Configuration		See the M2000 Store/Restore user manual for details on using the Token Copy features.																																												
	Store to Token																																														
	Restore from Token																																														
ADE	Protocol Type	The protocol type enables the ADE interface. Selecting S1 or S2 will automatically configure the Digital Input and Digital Output #1 for ADE operation. Manually configuring the input and output for ADE operation is not allowed and will result in a on-screen error. See " <i>ADE Interface</i> " on page 50 for further details. S1 – Standard ADE protocol S2 – Enhanced ADE protocol, provides additional digital information Disabled – disables and removed ADE configuration																																													
	Dial Type	4 – 8 dials																																													

Analog Calibrate	Custom Settings [Zero Scale: 0 mA] [Full Scale: 0 mA] 	To set the analog calibration custom settings, follow these steps from the <i>Advanced</i> menu: <ol style="list-style-type: none"> 1. Select Analog Calibrate to view the <i>Analog Calibrate</i> menu. 2. Select Custom Settings to view the <i>Custom Settings</i> display. 3. Select one of the following: <ul style="list-style-type: none"> • Offset 4 mA • Offset 20 mA 4. Configure desired offset. 5. Press [E] to save the option and to return to the <i>Custom Settings</i> menu. 6. Press [E] to return to the <i>Analog Calibrate</i> menu.
Factory Settings [Factory Set] 	To change the analog calibration factory settings, follow these steps from the <i>Advanced</i> menu: <ol style="list-style-type: none"> 1. Select Analog Calibrate to view the <i>Analog Calibrate</i> menu. 2. Select Factory Settings to view the <i>Factory Settings</i> display. 3. Select one of the following: <ul style="list-style-type: none"> • Calibration Point A • Calibration Point B 4. Set the calibration point to the measured output current. 5. Press [E] to save the option and to return to the <i>Factory Settings</i> menu. 6. Press [E] to return to the <i>Analog Calibrate</i> menu. 	

Advanced Features		
Software Filter	Description	The software filter operates as an acceleration filter. This filter when configured properly allows for filtering of fast changes in fluid flow. Generally, this filter is used in applications having highly conductive fluids. This filter is intended to help provide smoothing of the analog output and display fluctuations.
Activation [Off]	<p>The Activation parameter setting enables or disables the software acceleration filter.</p> <p>To change the Activation setting, follow these steps from the <i>Advanced</i> menu:</p> <ol style="list-style-type: none"> 1. Select Activation from the <i>Advanced</i> menu. 2. Select the desired setting. 3. Press [E] to save the option and to return to the <i>Advanced</i> menu. 	
Filter Delay [1]	<p>The Filter Delay parameter lets you set the amount of time that the flow will be held constant once the filter is activated. The filter is activated by an acceleration component of the fluid exceeding the configured limit.</p> <p>To change the Filter Delay follow these steps from the <i>Advanced</i> menu:</p> <ol style="list-style-type: none"> 1. Select Filter Delay, from the <i>Advanced</i> menu. 2. Select the desired setting. 3. Press [E] to save the option and to return to the <i>Advanced</i> menu. 	
Acceleration Factor [1]	<p>The Acceleration Factor parameter lets you set the maximum acceleration for a given pipe diameter and is dependent on the excitation frequency. The maximum fluid velocity is 12 m/s. The following equation defines the maximum fluid acceleration:</p> $\text{Acceleration(MAX)} = \text{Acceleration Factor} * 12 \text{ m/s} * \text{Pipe Area} * \text{Excitation Frequency} / 1.5$ <p>If the realized fluid acceleration exceeds the configured maximum acceleration, fluid flow will be held constant for the time set at the Filter Delay parameter.</p> <p>To change the Acceleration Factor setting, follow these steps from the <i>Advanced</i> menu:</p> <ol style="list-style-type: none"> 1. Select Acceleration Factor from the <i>Advanced</i> menu. 2. Select the desired setting. 3. Press [E] to save the option and to return to the <i>Advanced</i> menu. 	

Advanced Features		
Software Filter	Constant Flow [150 M ³ /Sec ²] 	<p>During normal flow conditions, there is always a non-zero acceleration component. For example, if acceleration of the flow activates the filter, the meter will assume constant flow for the duration of the filter delay time unless the flow returns within limits.</p> <p>Properly configured, this parameter will help offset excessive impacts of the filter delay. The Constant Flow parameter lets you set the acceleration limit for constant flow.</p> <p>To change the Constant Flow setting, follow these steps from the <i>Advanced</i> menu:</p> <ol style="list-style-type: none"> 1. Select Constant Flow from the <i>Advanced</i> menu. 2. Select the desired setting. 3. Press [E] to save the option and to return to the <i>Advanced</i> menu.
	Peak Detect [0 M ³ /Sec ²] 	<p>Peak Detect offers a diagnostic view of the acceleration components observed during flow conditions. This parameter records the “high water mark” of the measured accelerations component. This value will help to properly configure the Acceleration Factor parameter. Generally, you will set the acceleration factor at about 75% of the Peak Detect measurement.</p> <p>To reset the Peak Detect setting, follow these steps from the <i>Advanced</i> menu:</p> <ol style="list-style-type: none"> 1. Select Peak Detect from the <i>Advanced</i> menu. 2. Press [+] to reset. 3. Press [E] to return to the <i>Advanced</i> menu.
MDN Filter	Description	<p>This software filter operates as a Median filter. This filter is very responsive and can be used to help stabilize flow measurements. This filer is enabled by selecting a non-zero filter size. Supported filter sizes are:</p> <ul style="list-style-type: none"> • S5 - Size 5 • S7 - Size 7 • S9 - Size 9 <p>The filter technique will use the median value of the last Sx samples used for determining flow measurement.:</p>

Advanced Features	
Empty Pipe Cal. [Default] 	<p>Fluid conductivity impacts the performance of empty pipe measurements. If you require empty pipe detection, you should perform this empty pipe calibration procedure.</p> <p>Before starting the empty pipe calibration, verify that empty pipe detection is enabled. Also, run both the empty pipe and the full pipe calibration procedures.</p> <p>Calibrating an Empty Pipe</p> <p>Before calibrating an empty pipe, verify that the pipe is empty.</p> <p>To calibrate with an empty pipe, follow these steps from the <i>Advanced</i> menu:</p> <ol style="list-style-type: none"> 1. Select Empty Pipe Cal to view the <i>Calibration</i> menus. 2. Select Cal. Empty Pipe to view the <i>Empty Pipe Calibrate</i> menu. 3. To enable calibration, place the cursor on the calibration enable line and press [E]. <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <pre>EMPTY PIPE CALIBRATE Volts = 3.00 >Cal [ON] E=OFF Exit with Save</pre> </div> <ol style="list-style-type: none"> 4. Wait 30 seconds for voltage measurement to stabilize. 5. To save the setting, place the cursor on Exit with Save and press [E]. <p>Calibrating a Full Pipe</p> <p>Before calibrating a full pipe, verify that the pipe is full.</p> <p>To calibrate with a full pipe, follow these steps from the <i>Advanced</i> menu:</p> <ol style="list-style-type: none"> 1. Select Empty Pipe Cal to view the <i>Calibration</i> menus. 2. Select Cal. Full Pipe to view the <i>Full Pipe Calibrate</i> menu. 3. Enable calibration by placing the cursor on the calibration enable line and press [E]. <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <pre>FULL PIPE CALIBRATE Volts = 1.515 >Cal [OFF] E=ON Exit with Save</pre> </div> <ol style="list-style-type: none"> 4. Wait 30 seconds for voltage measurement to stabilize. 5. To save the setting, place the cursor on Exit with Save and press [E].

Advanced Features		
Security	Set Admin PIN [00000] 	<p>Users logged in with this PIN will have access to all M2000 procedures.</p> <p>To set the administrator's PIN, follow these steps from the <i>Advanced Menu</i>:</p> <ol style="list-style-type: none"> 1. Select Security to view the <i>Security</i> menu. 2. Select Set Admin PIN to view the <i>Admin PIN</i> display. 3. Set the five-digit PIN number to the desired value. 4. Press [E] to save the PIN and to return to the <i>Security</i> menu.
	Set Service PIN [00000] 	<p>Users logged in with this PIN will have access to all service level and user-level procedures. Service users will not have access to administrative procedures.</p> <p>To set the service PIN, follow these steps from the <i>Advanced Menu</i>:</p> <ol style="list-style-type: none"> 1. Select Security to view the <i>Security</i> menu. 2. Select Set Service PIN to view the <i>Service PIN</i> display. 3. Set the five-digit PIN number to the desired value. 4. Press [E] to save the PIN and to return to the <i>Security</i> menu.
	Set User PIN [00000] 	<p>Users logged in with this PIN will have access to user-level procedures. User at this level will not have access to administrative or service procedures.</p> <p>To set the user's PIN, follow these steps from the <i>Advanced Menu</i>:</p> <ol style="list-style-type: none"> 1. Select Security to view the <i>Security</i> menu. 2. Select Set User PIN to view the <i>User PIN</i> display. 3. Set the five-digit PIN number to the desired value. 4. Press [E] to save the PIN and to return to the <i>Security</i> menu.

Info/Help	
Error Counts [0] 	Description This menu provides a diagnostic view of the meter's performance. Below are several system diagnostic counters and their definitions. Use discretion when interpreting these counters. These values could be altered during system setup or when using the verification device. We suggest that you reset these counters before you start monitoring your system and look for conditions possibly affecting performance.
Detector	The number of times an invalid detector condition has been observed.
Empty Pipe	The number of times an empty pipe condition has been observed by the meter.
Full Scale	The number of times the flow has exceeded the full scale flow setting.
Totalizer	The number of times the totalizers have exceeded limits of the meter.
Pulse Sync.	The number of times the pulse outputs have fallen out of synchronization.
ADC Interrupt	The number of times an analog input measurement has been missed.
ADC Range	The number of times the analog input measurement range has been exceeded.
System Error	A diagnostic system message indicating the reason for a system reset.
System Resets	The number of times the meter has been reset.
System Reset ID	Diagnostic information about a system reset as a result of expired internal timers.
Token Errors	Indicates the number of parameter copies from a memory token that failed to be copied to the meter.

Info/Help	
Rollover Counts [0] 	<p>The number of times the totalizers have rolled over 9,999,999,999 (10 billion). As the meter rolls over, a status indicator appears in the display. When this occurs, we suggest that you record the totalizers and rollover counter and reset the totalizers. Resetting totalizers will also clear the rollover counter.</p> <p>For a meter configured in bidirectional mode, rollover is represented by the net totalizer (TN) as "*****". During this condition, the net totalizer (TN) can be calculated using the following equation:</p> $T(FWD) = [(ROLLOVER_{T+} \times 10,000,000,000) + T+]$ $T(REV) = [(ROLLOVER_{T-} \times 10,000,000,000) + T-]$ $TN = T(FWD) - T(REV)$ <p>Where $ROLLOVER_{Tx}$ is the rollover count for the appropriate totalizer</p> <p>For a meter configured in unidirectional mode, the totalizer can be calculated using the following equation:</p> $T1 = [(ROLLOVER_{T1} \times 10,000,000,000) + T1]$ $T2 = [(ROLLOVER_{T2} \times 10,000,000,000) + T2]$ <p>Where $ROLLOVER_{Tx}$ is the rollover count for the appropriate totalizer</p>
PowerUp Counter [Not applicable] 	The number of times that the unit has been powered on.
Power Off Totalizer [Not applicable] 	The length of time that the unit has been without power.
Version Info [Not applicable] 	The current software version.
Serial Number [Not applicable] 	The manufacturing serial number in the format YYMM####. Where YYMM indicates year and month of manufacturing and ##### indicates the sequence number.

Info/Help	
Meter Tag Name	For PROFIBUS – This parameter is only programmable over external PROFIBUS communications.
Daughterboard Information	Describes current version of attached daughterboard. NOTE: RS485 daughterboard is not recognized because it is a pass-through device rather than an intelligent protocol converter like Hart-to-MODBUS.
Polarization Voltage	Diagnostic voltage to help determine if the meter or application is performing optimally.
Restore Defaults [Not applicable] 	Restores all non-calibrated parameters to the factory defaults.

Language Select	
Language Select [English] 	The M2000 supports one alternate language along with English. This alternate language choice is set at the factory. The options are: Spanish, German, Czech or French. To select the language, follow these steps from the Language Select menu : 1. Select English or the Alternate Language . 2. Press [E] to save the selection.

ADE INTERFACE

This feature requires firmware version 1.10 or later. Reference Badger Meter P/N 6734-003 to obtain a firmware upgrade kit. Enabling the meter as an ADE register requires three settings, all within the advanced menu, to be configured.

- Unit Multiplier – Selects the resolution of the display totalizer.
- Protocol Type – Selects the type of information to be transmitted to the ADE transmitter.
- Dial Type – Enables ADE and selects the number of significant totalizer digits to transmit.

Changing the dial type from Disabled will automatically configure the necessary digital inputs/outputs. It is not allowed to manually change the digital inputs/outputs within the *Input/Outputs* menu. Below is a wiring diagram for connecting an ADE transmitter to the meter.

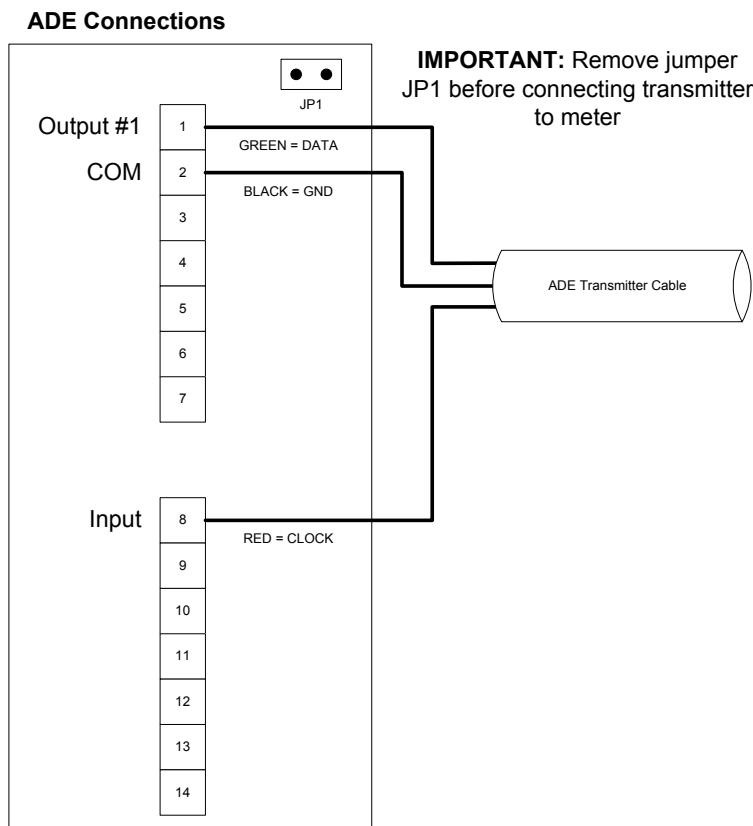


Figure 20: ADE interface

The following table demonstrates how the totalizers are displayed under various configurations of the Unit Multiplier (that is, resolution) and Dial Type. The non-shaded digits are transmitted as defined by the dial type.

For example, if the dial type is 4-dial and the resolution is 10000 then an arbitrary totalizer value of 99999999 is displayed on the meter as 9999**0000** and 9999 is transmitted to the receiving application. In this configuration it will take 10000 units (i.e. USG) before the display totalizer is updated to a new value. For this example the display totalizer will rollover to 0000**0000**.

Dial Type	Unit Multiplier (Resolution)	Display Digits									
		1	2	3	4	5	6	7	8	9	0
4 dial	10000			1	2	3	4	0	0	0	0
	1000				1	2	3	4	0	0	0
	100					1	2	3	4	0	0
	10						1	2	3	4	0
	1							1	2	3	4
	0.1						1	2	3	.	4
	0.01						1	2	.	3	4
	0.001						1	.	2	3	4
	0.0001					0	0	1	2	3	4
5 dial	10000		1	2	3	4	5	0	0	0	0
	1000			1	2	3	4	5	0	0	0
	100				1	2	3	4	5	0	0
	10					1	2	3	4	5	0
	1						1	2	3	4	5
	0.1					1	2	3	4	.	5
	0.01					1	2	3	.	4	5
	0.001					1	2	.	3	4	5
	0.0001					1	.	2	3	4	5
6 dial	10000	1	2	3	4	5	6	0	0	0	0
	1000		1	2	3	4	5	6	0	0	0
	100			1	2	3	4	5	6	0	0
	10				1	2	3	4	5	6	0
	1					1	2	3	4	5	6
	0.1				1	2	3	4	5	.	6
	0.01				1	2	3	4	.	5	6
	0.001				1	2	3	.	4	5	6
	0.0001				1	2	.	3	4	5	6
7 dial	10000	Not Applicable – Not enough display digits									
	1000	1	2	3	4	5	6	7	0	0	0
	100		1	2	3	4	5	6	7	0	0
	10			1	2	3	4	5	6	7	0
	1				1	2	3	4	5	6	7
	0.1				1	2	3	4	5	.	7
	0.01				1	2	3	4	5	.	7
	0.001				1	2	3	4	.	5	7
	0.0001				1	2	3	.	4	5	6

Dial Type	Unit Multiplier (Resolution)	Display Digits									
		1	2	3	4	5	6	7	8	9	0
8 dial	10000	Not Applicable – Not enough display digits									
	1000	Not Applicable – Not enough display digits									
	100	1	2	3	4	5	6	7	8	0	0
	10		1	2	3	4	5	6	7	8	0
	1			1	2	3	4	5	6	7	8
	0.1		1	2	3	4	5	6	7	.	8
	0.01		1	2	3	4	5	6	.	7	8
	0.001		1	2	3	4	5	.	6	7	8
	0.0001		1	2	3	4	.	5	6	7	8

It is important to understand that the totalizers will be represented in a manner equivalent to an actual ADE register. For example, 1 USG on a 4 dial will be transmitted/displayed as "0001". If in bidirectional mode, -1 USG will be transmitted/displayed as "9999".

The protocol type has two options:

- V1 – meter provides single totalizer, Tn (bi-directional) or T1 (uni-directional)
- V2 – meter provides extended information (For ORION Cellular, ORION Fixed Network (SE) or ORION Migratable (ME))

The additional information provided by protocol type V2 is only accessible for specific models of the ADE transmitter (i.e. ORION SE or ORION ME). The additional information of protocol type V2 includes, status information of the meter, meter identification, a second totalizer reading (T+ or T2), relative flow rate (0...100%), and flow direction.

STORE / RESTORE FEATURE

The Store/Restore feature is intended to save installation costs and reduce installation time. This feature is also intended to protect meter configuration and assure the operator that the meter is properly configured. Over time and handling of the meter, the meter configuration could change. The Store/Restore feature allows the meter to be quickly set to the operator's original configuration. Refer to the M2000 Store/Restore user manual for details on this feature.

DATA LOGGING FEATURE

The Data Logging feature records three types of events to a memory token:

- Totalizer/error events
- Configuration change events
- Startup events (power up, power down or reset events)

Each type of event is recorded into three separate files stored on the memory token. These files are extracted using the provided flow meter tool software over the RS232 communication link. Refer to the M2000 Data Logging user manual for details on this feature.

MAINTENANCE

Mandatory, routine or scheduled maintenance should not be required for the M2000 Mag Meter electronics or flow tube after proper installation.

However, some instances may require personnel to perform the following:

- Flow tube and electrode cleaning
- Fuse replacement
- Circuit board replacement

⚠ WARNING

- ***DISCONNECT MAIN POWER TO THE UNIT BEFORE ATTEMPTING ANY DEVICE MAINTENANCE OR CLEANING.***
- ***DO NOT CLEAN COMPONENTS INSIDE THE AMPLIFIER OR JUNCTION BOX.***

Cleaning the Flow Tube and Electrode

At times flow tube, electrodes, amplifier/junction box housings and the amplifier window may need periodic cleaning, depending on process fluid properties, fluid flow rate and surrounding environment.

Clean the flow tube and electrodes by following the material handling and cleaning procedures documented in Material Safety Data Sheet (MSDS) guidelines for the product(s) that were in contact with the flow tube and electrodes.

Should flow tube and/or electrode cleaning become necessary:

1. Disconnect detector from pipeline.
2. Clean electrodes according to MSDS guidelines.
3. Reconnect detector to pipeline.

Replacing the Fuse

⚠ WARNING

DISCONNECT MAIN POWER TO THE UNIT BEFORE ATTEMPTING ANY DEVICE MAINTENANCE. RISK OF ELECTRICAL SHOCK. REPLACE THE FUSE ONLY WITH 250V AC, 2 AMP, SLOW BLOW (5 X 20 MM). AUTHORIZED PERSONNEL MUST REPLACE FUSES.

Replacing the Circuit Board

Refer to the M-Series M2000 Interchangeability Procedure Application Brief for information on replacing circuit boards.

TROUBLESHOOTING

The M2000 mag meter is designed for many years of optimal performance. However, should it malfunction, there are certain things that we recommend you check before contacting our Technical Support department or your local Badger Meter Representative.

NOTE: If the fluid measured has a high concentration of conductive solids, deposits may accumulate on the internal liner walls and electrodes. These deposits will cause a reduction of the measuring output. Thus, Badger Meter recommends that you remove the meter and inspect the liner and electrodes after six months. If deposits are found, remove them with a soft brush. Repeat inspection process every six months or until an appropriate inspection cycle can be established for the specific application.

NOTE: Other general conditions include:

Description	Possible Cause	Recommended Action
Flow is present but display is "0"	Digital input is holding flow. Disconnected signal cable. Detector mounted opposite of the main flow direction (see arrow on the nameplate). Coil or electrode cables exchanged. Improper low flow cutoff or full scale flow.	Check signal cable. Turn detector by 180° or switch terminal E1 and E2 or reprogram to bidirectional mode. Check cable connections for cross wiring. Verify digital input configuration. Replace configuration defaults.
Inaccurate measuring	Improper calibration. Wrong calibration parameter. Pipe not fully filled, or air in pipe. Invalid fluid conductivity. Invalid fluid mixture.	Restore calibration defaults. Check the parameters (detector factor and size) according to supplied data sheet. Check if meter is completely filled with fluid. Purge line to eliminate air bubbles.
No display	No power. Incorrect power. Bad wiring connections. Blown fuse.	Apply power. Check power value. Replace fuse (2 amp, 250V AC, slow blow 5 x 20 mm). Check display ribbon cable.
Flow rate value known to be wrong	Detector factor. Deposits on electrodes and/or liner. Incorrect pipe size programmed.	Check value on label. Check and remove deposits. Check size if necessary.
Flow rate indication unstable	Cable issue. Grounding issue. Partially full pipe. Air in pipe. Amplifier location – outside electrical. Invalid fluid conductivity.	Make sure cable is shielded and not vibrating. Make sure meter is properly grounded to a good earth ground. Make sure pipe is full of fluid. Make sure fluid does not contain air bubbles. Make sure amplifier is not too close to sources of electrical interference.

Menu Manager Configuration Errors		
Error	Description	Recommended Action
100	ADE: Configuration of the ADE interface is invalid.	<p>This error is displayed when an invalid modification to either of the following menu parameters is detected: Protocol Type, Dial Type, Unit Multiplier, Digital Input Function Type or Digital Output Function Type.</p> <ol style="list-style-type: none"> Configuring the M2000 as an ADE interface has the following limitations, Protocol Type V1 is only allowed if number of dials is less than 8. The resolution of the totalizers (i.e. Unit Multiplier) must be set to something other than OFF. For 8 dial configuration, a resolution of 10000 and 1000 are not supported. There are not enough display digits to accommodate 8 dials and greater than 100 units of resolution. For 7 dial configuration, a resolution of 10000 is not supported. There are not enough display digits to accommodate 7 dials and greater than 1000 units of resolution.
101	ADE: Enabling/Disabling ADE operation is invalid	<p>This error is observed when Digital input or output function is manually selected for ADE operation. Enabling or Disabling ADE operation can only be accomplished by setting the ADE protocol type.</p>
110	Output 1/2: Pulse Output Configuration Error	<p>This error is observed when improperly configuring either the full scale flow, pulse per unit, pulse width or digital output function type for pulse output operation. Preparing these parameters for pulse output operation (i.e. forward or reverse) has limitations that are monitored by the menu manager. This error can indicate the following configuration violations:</p> <ol style="list-style-type: none"> Pulse Frequency exceeds limits at full scale flow Pulse duty cycle is less than 50% at full scale flow (i.e. pulse on time > pulse off time) AMR Pulse Frequency exceeds limit at full scale flow <p>The pulse frequency limit is 10 kHz when the pulse width is 0 (i.e. 50% duty cycle).</p> <p>The pulse frequency limit is 1 / (2 * Pulse Width) when the pulse width is non-zero in order to achieve a 50% duty cycle.</p> <p>For AMR operation, the frequency limit is 3 Hz.</p> <p>Follow these steps for configuring meter for pulse output operation:</p> <ol style="list-style-type: none"> Set PPU to zero for both output 1 and 2 If necessary, set full scale flow appropriately for application Set PW as required by equipment receiving pulse transmissions from meter. Observe frequency limits for non-zero pulse widths. Determine the desired pulse frequency at a typical flow rate (i.e. 1000 Hz @ 250 GPM) Calculate ratio of typical flow rate to full scale flow: ratio = typical flow rate / full scale flow (i.e. 250 GPM / 500 GPM = 0.5) Calculate flow rate conversion factor: For GPM, conversion factor = 1/60, for GPH, conversion factor = 1/3600, for GPS, conversion factor = 1 Calculate PPU: PPU = (Desired pulse frequency at typical flow rate / ratio) / [Full Scale Flow * (conversion factor)] = (1000 / 0.5) / [500 * (1/60)] = 240 Pulse / Gallon If an error is received consider reducing value of full scale flow and ensuring desired pulse frequency is within limits. Then redo steps 4-7 <p>If not using the pulse outputs, set the pulses per unit to zero to allow for re-configuration of the full scale flow. If it is required to use the pulse outputs, re-evaluate the pulse output configuration. Consider recording and clearing totalizers following pulse output configuration"</p>
120	Display: Totalizer Conversion Error – Totalizer cannot be properly converted for display	<p>This error is observed while trying to change the totalizer units. Limits of display will prevent improper configuration of the volume unit dependent on current totalizer values. Consider recording and cleaning totalizers prior to changing totalizer.</p>
121	Output 1/2: Pulse Output Configuration Error	<p>This error is observed when changing the totalizer units of measure. This error implies the pulse configuration exceeds limits (see error 110). Please note the pulses per unit is not automatically updated on volume unit re-configuration. The pulses per unit should be manually changed to accommodate the desired units of measure. It may be necessary to set the pulses per unit to zero then change to the desired totalizer units.</p>
140	Output 3: Configuration Error – Full scale frequency exceeds limits of relay (1000 Hz)	<p>Reduce full scale frequency setting of output when hardware is configured for relay operation.</p>
150	Output 3: Configuration Error – Full scale frequency exceeds limits (10 kHz)	<p>Reduce full scale frequency setting of output when hardware is configured for open collector operation.</p>
170	Output 1/2: Output Type Configuration Error	<p>This error is observed when the function type is 24V DC and the output type is changed from Normally Open to Normally Closed. It is required for 24V DC output operation that the output type be Normally Open.</p>

Menu Manager Configuration Errors		
Error	Description	Recommended Action
171	Output 1/2: Output Type Configuration Error	This error is observed when the function type is ADE and the output type is changed from Normally Open to Normally Closed. It is required for ADE operation that the output type be Normally Open
190	Full Scale Flow: Entered Value exceeds limits	Value entered exceeds the absolute maximum flow the meter supports. Reduce the value for this parameter or consider increasing pipe diameter.

Display Error / Status Messages		
Error Message	Possible Cause	Recommended Action
Err: Detector	No detector connection with amplifier.	Check detector and cable connections in accordance with this manual.
	Connection between amplifier and detector	Contact Technical Support.
	Supply voltage too low.	Contact Technical Support.
	Grounded coils in meter.	Contact Technical Support.
	Water in detector.	Contact Technical Support.
Err: Empty pipe	Pipe may not be full.	Make sure all trapped air is out of system. If fluid or fluid conductivity recalibrate the parameter.
Err: Full scale	Actual flow rate is exceeding programmed flow.	Reduce flow rate or increase the programmed full scale value by more than 5%.
Err: AD-Range	AD-Converter is exceeding signal limits.	Check the grounding scheme of the meter installation. See grounding section in this manual. Verify pipe is not empty.
Err: AD-INT	Initialization of AD-Converter unsuccessful.	Contact Technical Support.
Err: Rollover	Rollover counters have exceeded limit.	Clear all totalizers.
Err: Rollover Status	Totalizer rollover has occurred.	Reload totalizer then clear all totalizers.
Err: Simulation	I/O simulator is enabled.	Disable simulator in I/O menu.

SPECIFICATIONS

Flow Range	0.10...39.4 ft/s (0.03...12 m/s)	
Accuracy	± 0.25 percent of rate for velocities greater than 1.64 ft/s (0.50 m/s) ± 0.004 ft/s (± 1 mm/s) for velocities less than 1.64 ft/s (0.50 m/s)	
Repeatability	$\pm 0.1\%$	
Power Supply	AC Power Supply: 85...265V AC; Typical Power: 20V A or 15W; Maximum Power: 26V A or 20W Optional DC Power Supply: 10...36V DC; Typical Power: 10W; Maximum Power: 14W	
Analog Output	4...20 mA, 0...20 mA, 0...10 mA, 2...10 mA (programmable and scalable) Voltage sourced 24V DC isolated. Maximum loop resistance < 800 ohms.	
Digital Output	Four total, configurable 24V DC sourcing active output (up to 2), 100 mA total, 50 mA each; sinking open collector output (up to four), 30V DC max, 100 mA each; AC solid-state relay (up to 2), 48V AC, 500 mA max	
Digital Input	Max 30V DC (programmable – positive zero return, external totalizer reset or preset batch start)	
Frequency Output	Scalable up to 10 kHz, open collector up to 1 kHz, solid-state relay	
Misc Output	High/low flow alarm (0...100% of flow), error alarm, empty pipe alarm, flow direction, preset batch alarm, 24V DC supply, ADE	
Communication	RS232 Modbus RTU; RS485 Modbus RTU, HART, Profibus DP require separate daughterboards	
Pulse Width	Scalable up to 10 kHz, passive open collector up to 10 kHz, active switched 24V DC. Up to two outputs (forward and reverse). Pulse width programmable from 1...1000 ms or 50% duty cycle.	
Processing	32-bit DSP	
Empty Pipe Detection	Field tunable for optimum performance based on specific application	
Excitation Frequency	1 Hz, 3.75 Hz, 7.5 Hz or 15 Hz (factory optimized to pipe diameter)	
Noise Dampening	Programmable 0...30 seconds	
Low Flow Cut-Off	Programmable 0...10% of maximum flow	
Galvanic Separation	250V	
Fluid Conductivity	Minimum 5.0 micromhos/cm	
Fluid Temperature	With Remote Amplifier: PFA, PTFE & Halar 302° F (150° C) With Meter-Mounted Amplifier: Rubber 178° F, (80° C), PFA, PTFE & Halar 212° F (100° C)	
Ambient Temperature	-4...140° F (-20...60° C)	
Relative Humidity	Up to 90 percent non-condensing	
Flow Direction	Unidirectional or bidirectional two separate totalizers (programmable)	
Totalization	Programmable/resettable	
Units of Measure	Ounce, pound, liter, US gallon, imperial gallon, barrel, hectoliter, mega gallon, cubic meter, cubic feet, acre feet	
Display	4 x 20 character display with backlight	
Programming	Three-button, external manual or remote	
Amplifier Housing	Cast aluminum, powder-coated paint	
Detector Housing	Carbon steel welded	
Pipe Spool Material	316 stainless steel	
Flanges	Standard: ANSI B16.5 Class 150 RF cast steel; Optional: 300 lb cast steel, 316 stainless steel	
Liner Material	PFA up to 3/8", PTFE 1/2...24", soft and hard rubber from 1...54", Halar® from 14...40"	
Electrode Materials	Standard: Alloy C; Optional: 316 stainless steel, gold/platinum plated, tantalum, platinum/rhodium	
Mounting	Meter mount or remote wall mount (bracket supplied)	
Locations	Indoor and outdoor	
Meter Enclosure Classification	NEMA 4X (IP66); Optional: Submersible NEMA 6P (IP67), remote amplifier required	
Junction Box Enclosure Protection	For remote amplifier option: powder-coated die-cast aluminum, NEMA 4 (IP66)	
Cable Entries	1/2" NPT cord grip (3)	
Optional Stainless Steel Grounding Rings	Meter Size	Thickness (of one ring)
	Up through 10"	0.135"
	12...54"	0.187"
NSF Listed	Models with hard rubber liner, 4" size and up; PTFE liner, all sizes	
Token Features	Data Logging (Blue token); Store/Restore (Red token); Firmware Upgrade (Black token)	

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Legacy Document: IOM-175-04 PN 53400-190

Attachment 6 - HDPE DR-11 Piping Specifications

SECTION  **B**
SECCIÓN

ASTM HDPE MATERIALS

MATERIALES HDPE ASTM



Standards Worldwide

HIGH-DENSITY POLYETHYLENE PIPE

High density polyethylene (HDPE) pipe is an exceptional piping product well-suited for a broad range of demanding applications. Tough, resilient HDPE piping is widely used in municipal water and sewer applications, natural gas distribution, industrial process piping, fire water loops, mining/slurry handling systems and many more types of systems. With its strong, butt-fused joints and long-term ductility, HDPE pipe can be installed in numerous ways such as direct burial, slip-lining, pipe-bursting, and directional drilling. As a leading global distributor of HDPE piping systems and fusion equipment, along with fusion and fabrication services, ISCO Industries is your primary resource for all of your HDPE piping needs.

Consider some of these characteristics of HDPE Pipe:

- Economical
- Chemical/Corrosion Resistant
- Zero Leak-Rate
- Hydraulically Smooth
- Fatigue and Surge Resistant
- Long Design Life
- Tappable
- Easily Installed
- Small to Large Diameters
- Non-Toxic, Non-Tasting
- Lightweight
- Reliable
- Long-term strength and ductility
- Flexible and Coil-able
- Heat Fused
- Mechanically Joined (As Needed)
- Compatible with other systems
- Weather Resistant
- Impact Resistant
- Freeze Resistant
- Durable
- Abrasion Resistant
- Inert
- Self-Restrained Pipe (Monolithic)
- Listed and Approved

IMPORTANT STANDARDS FOR HIGH DENSITY POLYETHYLENE (HDPE) PIPE

As with any engineering material, there are numerous standards and codes by which HDPE pipe and fittings are produced, designed and installed. Principle among these are the applicable standards published by ASTM International (formerly known as the American Society for Testing and Materials). Other additional standards and/or codes such as AWWA, DOT, API or others may apply to specific installations or uses of HDPE pipe as well. What follows is a partial listing of some of the principle standards pertaining to HDPE piping within the North American market area.

TUBERÍA DE POLIETILENO DE ALTA DENSIDAD

La tubería de polietileno de alta densidad (HDPE) es un producto de tubería excepcional, bien adaptado a una amplia gama de aplicaciones exigentes. La tubería HDPE es fuerte y elástica y es ampliamente utilizada en aguas municipales y aplicaciones en alcantarillado, distribución de gas natural, tubería para procesamientos industriales, sistemas de agua contraincendios, sistemas de manejo de fangos / minería y muchos otros tipos de sistemas. Con sus uniones fuertes, fundidas a tope y ductilidad a largo plazo, la tubería HDPE puede instalarse de numerosas maneras tales como directamente enterrada, métodos de instalación en zanja y perforación direccional. Como un distribuidor líder a nivel mundial de sistemas con tubería HDPE y equipos de fusión, junto con servicios de fusión y fabricación, ISCO Industries es su principal recurso para todas sus necesidades en cuanto a tubería HDPE.

Considere algunas de estas características de la tubería HDPE:

- Económica
- Resistente a químicos/ a la corrosión
- Cero porcentaje de fugas
- Hidráulicamente suave
- Resistente a la fatiga y a sobrecargas de presión.
- Larga vida útil
- Derivable
- Fácil de instalar
- De diámetros pequeños a grandes
- No tóxica, no degustable
- Liviana
- Confiable
- Resistencia y ductilidad a largo plazo
- Flexible y rebobinable
- Termo-fundida
- Unido mecánicamente (si sea necesario)
- Compatible con otros sistemas
- Resistente a la intemperie
- Resistente a golpes
- Resistente a la congelación
- Durable
- Resistente a la abrasión
- Inerte
- Tubería auto-restringible (monolítica)
- Listada y Aprobada

NORMAS IMPORTANTES PARA POLIETILENO DE ALTA DENSIDAD (HDPE)

Como con cualquier material de ingeniería, hay numerosas normas y códigos mediante los cuales la tubería y accesorios HDPE son elaborados, diseñados e instalados. Entre estos principios están las normas aplicables publicadas por ASTM International (anteriormente conocida como Sociedad Americana para el Ensayo de Materiales). Otras normas y/o códigos adicionales como AWWA, DOT, API y otros pueden también aplicarse a instalaciones o a usos específicos de la tubería HDPE. Lo que sigue es una lista parcial de algunas normas de principios pertinentes a la tubería HDPE en el área del mercado norteamericano

PIPE RESIN STANDARDS

ASTM D3350 - “Standard Specification for Polyethylene Plastics Pipe and Fitting Materials”.

The quality of HDPE pipe starts with the resin from which it is produced. ASTM D3350 defines the basic physical property requirements of the polyethylene compound that is used to make the pipe or fittings.

PIPE DIMENSIONS AND MANUFACTURING STANDARDS

ASTM F 714 - “Standard Specification for Polyethylene (PE) Pipe (SDR-PR) Based on Outside Diameter”.

Pipe produced in accordance with this standard is used across a broad variety of municipal, industrial, and various water-related applications. This standard includes IPS, DIPS and metric sizing systems in nominal outside diameters from 3" - 54".

ASTM D 2513 - “Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing and Fittings”. Polyethylene pipe and other plastics for natural gas distribution are described in great detail in this standard.

ASTM D 3035 - “Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter”.

Most HDPE water tubing (½" to 3") is made to the dimensions in this standard. This standard was revised to include IPS sizes up through nominal 65" outside diameter and DIPS sizes up through nominal 48" outside diameter for municipally oriented PE pipe applications or services.

ASTM F 2619 - “Standard Specification for High Density Polyethylene (PE) Line Pipe”.

This standard includes HDPE pipe in sizes from ½" to 65" for various oil and gas producing applications such as oil, dry or wet gas, multiphase fluids and non-potable oil field water.

INSTALLATION STANDARDS

ASTM D 2321 - “Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications”

ASTM D 2774 - “Standard Practice for Underground Installation of Thermoplastic Pressure Piping”

ASTM F 585 - “Standard Practice for Insertion of Flexible Polyethylene Pipe into Existing Sewers”

ASTM F 1668 - “Standard Guide for Construction Practices for Buried Plastic Pipe”

ASTM F 1962 - “Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit Under Obstacles, Including River Crossings”

REQUISITOS DE LA RESINA DE LA TUBERÍA

ASTM D3350 – “Especificación estándar para materiales de tubería y accesorios plásticos de polietileno”. La calidad de la tubería HDPE empieza con la resina con la cual es elaborada. ASTM D3350 define los requisitos básicos de las propiedades físicas del compuesto de polietileno usado para hacer tubería y accesorios.

REQUISITOS DIMENSIONALES Y DE FABRICACIÓN DE LA TUBERÍA

ASTM F 714 – “Especificación estándar para la tubería (SDR-PR) de polietileno (PE) basada en el diámetro exterior.” Esta norma se usa para la mayoría de aplicaciones con tubería HDPE de gran diámetro (4 a 63 pulgadas) aparte de la tubería para gas.

ASTM D 2513 – “Especificación estándar para tubería termoplástica de presión para gas, entubado y accesorios”. La tubería de polietileno y de otros plásticos para la distribución de gas natural se describen con mucho detalle en esta norma”

ASTM D 3035 –“Especificación estándar para la tubería (DR-PR) plástica de polietileno (PE) basándose en el diámetro exterior controlado”. La mayoría de la tubería HDPE para agua (de 1/2 a 3 pulgadas) está hecha según dimensiones de esta norma. Si bien, se proveen tuberías de tamaños hasta 24 pulgadas, muy poca tubería de gran diámetro se hace según esta norma.

ASTM F 2619 —“Especificación estándar para tubería de conducción de polietileno (PE) de alta densidad” Esta norma incluye la tubería HDPE con tamaños desde ½ a 65 pulgadas para varias aplicaciones de producción de crudo y gas tales como crudo, gas seco o húmedo, fluidos de fase múltiple y agua no-potable de campos petrolíferos.

NORMAS DE INSTALACIÓN

ASTM D 2321 – “Práctica estándar para la instalación subterránea de tubería termoplástica en alcantarillas u otras aplicaciones de flujo por gravedad”

ASTM D 2774 – “Práctica estándar para la instalación subterránea de tubería termoplástica de presión”

ASTM F 585 – “Práctica estándar para la inserción de tubería flexible en alcantarillas existentes”

ASTM F 1668 – “Guía estándar de prácticas de construcción para tubería plástica enterrada”

ASTM F 1962 –“Guía estándar para uso en perforación direccional de máxima horizontalidad para la colocación de tubería o conducto de polietileno debajo de obstáculos, incluidos cruces de ríos”

ASTM F 2164 - "Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure".

AMERICAN WATER WORKS ASSOCIATION STANDARDS

ANSI/AWWA C 901 - "Polyethylene Pressure Pipe and Tubing, .5 in. (13 mm) Through 3 in. (76 mm) for Water Service"

ANSI/AWWA C 906 - "Polyethylene Pipe and Fittings, 4 in. (100 mm) through 63 in. (1,575 mm) for Water Distribution"

PIPE JOINING STANDARDS

ASTM F 2620 - "Standard Practice for Heat Fusion of Polyethylene Pipe and Fittings"

ASTM D 2657 - "Standard Practice of Heat Fusion Joining of Polyolefin Pipe and Fittings"

ASTM F 1290 - "Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings"

FITTING STANDARDS

ASTM D 3261 - "Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and tubing"

ASTM F 1055 - "Standard Specification for Electrofusion Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing"

ASTM F 1759 - "Standard Practice for Design of High Density Polyethylene (HDPE) Manholes for Subsurface Applications"

ASTM F 2206 - "Standard Specification for Fabricated Fittings of Butt-Fused Polyethylene (PE) Plastic Pipe, Fittings, Sheet Stock, Plate Stock or Block Stock"

CANADIAN STANDARDS ASSOCIATION

CAN/CSA 137 - "Thermoplastic Pressure Piping Compendium"

OTHER USEFUL REFERENCES

Handbook of Polyethylene Pipe, A publication of the Plastics Pipe Institute (www.plasticpipe.org)

AWWA M55, PE Pipe - Design and Installation, A Manual of Water Supply Practices published by the American Water Works Association

ASTM F 2164 - "Práctica estándar para la prueba de fugas sobre el terreno de los sistemas presurizados con tubería de polietileno (PE) mediante presión hidrostática"

NORMAS DE LA ASOCIACIÓN AMERICANA DE DISTRIBUCIÓN DE AGUA

ANSI/AWWA C 901-2005 - "Tubo y tubería de presión de polietileno, 0,5 pulgadas (13mm) hasta 3 pulgadas (76mm) para servicios de agua"

ANSI/AWWA C 906-2006 - "Tubería y accesorios de polietileno, de 4 pulgadas (100mm) hasta 63 pulgadas (1.575mm) para distribución de agua"

NORMAS PARA LA UNIÓN DE TUBERÍAS

ASTM F 2620 - "Práctica estándar para la termo-fusión de tubería y accesorios de polietileno"

ASTM D 2657 - "Práctica estándar para unión por termo-fusión de tubería y accesorios de polietileno"

ASTM F 1290 - "Práctica estándar para unión por electro-fusión de tubería y accesorios de poliolefina"

NORMAS PARA ACCESORIOS

ASTM D 3261 - "Especificación estándar para Polietileno de la Fusión de Calor del Extremo (PE) Accesorios de Plástico para Polietileno (PE) Tubo de Plástico y tubería"

ASTM F 1055 - "Especificación estándar para la electro-fusión de accesorios para tubo y tubería de polietileno de diámetro externo controlado"

ASTM F 1759 - "Práctica estándar para el diseño de entradas a alcantarillas de polietileno de alta densidad (HDPE) para aplicaciones bajo superficie"

ASTM F 2206 - "Especificación estándar para accesorios fabricados de tubería plástica de polietileno (PE) fundida a tope, accesorios, reservas de láminas de planchas y de bloques"

ASOCIACIÓN DE NORMAS CANADIENSES

CAN/CSA 137 - "Compendio de tubería termoplástica de presión"

OTRAS REFERENCIAS ÚTILES

Manual de tubería de polietileno, una publicación del instituto de tubería plástica (www.plasticpipe.org)

AWWA M55, Tubería PE - Diseño e instalación, un manual de prácticas de abastecimiento de agua publicado por la asociación americana de abastecimiento de agua.



San Diego County Desalination Plant: www.isco-pipe.com/SanDiegoCounty

SPECIFICATIONS FOR HDPE PIPE

Polyethylene piping systems are defined or specified using two important criteria: the ASTM D 3350 cell classification and the ASTM F 412 thermoplastic piping material designation code. For many years, the ASTM D 3350 cell classification consisted of a series of six digits followed by one letter, shown in Table 1. The six digits equate to the specified level of performance required in six separate physical properties defined within the standard. The final letter specifies the color or UV-resistance requirement. ASTM D 3350 also includes a requirement for testing the resistance of the polyethylene compound to the oxidative effects of chlorine. The six digits and one letter are now supplemented by a chlorine resistance categorization. Taken together the D 3350 cell classification establishes a minimum range of technical performance for the PE compound used to produce the pipe.

The F 412 thermoplastic piping material designation code further defines the performance requirement of the pipe produced from a particular PE compound. This code consists of an abbreviation for the basic material as defined within the ASTM standards. The standardized abbreviation for polyethylene is the term "PE". This basic polymer designation is then followed by a series of four digits. The first two digits relate directly to specific physical properties for the compound as defined within ASTM D 3350. The last two digits are the long-term hydrostatic stress rating as recommended by the Hydrostatic Stress Board of the Plastic Pipe Institute in hundreds of psi. The long-term hydrostatic stress rating is the hydrostatic design basis (HDB) multiplied by the appropriate design factor (DF).

So the thermoplastic piping material designation code follows the form below.

PEXYZZ, the format of the thermoplastic material designation code for PE pipe

Where: **PE** indicates polyethylene

X is the characteristic density range for the compound used to make the pipe as defined within ASTM D3350

Y is the characteristic slow crack growth resistance range for the compound used to make the pipe as defined within ASTM D3350

ZZ is the long-term hydrostatic stress at 73°F, expressed in hundreds of psi

ESPECIFICACIONES PARA LA TUBERÍA HDPE

Los sistemas de tubería de polietileno se definen o especifican usando dos importantes criterios: La célula de clasificación de ASTM D 3350 y el código de designación de material termoplástico para tubería ASTM F 412. El ASTM D 3350 consiste en una serie de seis dígitos seguidos por una letra. Los seis dígitos corresponden al nivel especificado del desempeño requerido en seis propiedades físicas separadas definidas dentro de la norma. La letra final especifica el color o la resistencia a los UV que se exige. Todo Junto la célula de clasificación D 3350 establece un margen mínimo de desempeño técnico para el compuesto de PE usado para elaborar la tubería

El código F 412 de designación de material termoplástico para tubería define mejor la exigencia al desempeño de la tubería elaborada a partir de un compuesto de PE en particular. Este código consiste en una abreviación del material básico según se lo define en las normas ASTM. La abreviación estandarizada para el polietileno es "PE". Esta designación básica del polímero es seguida de una serie de cuatro dígitos. Los primeros dos dígitos se relacionan directamente con propiedades físicas específicas del compuesto según lo definido en ASTM D 3350. Los últimos dos dígitos representan la tasa de fatiga hidrostática a largo plazo según lo recomendado por la junta para la fatiga hidrostática del instituto de tubería plástica en cientos de PSI. La tasa de la fatiga hidrostática a largo plazo es igual a la base del diseño hidrostático (HDB) multiplicado por el factor de diseño apropiado (DF)

Así el código de designación del material de la tubería termoplástica sigue la forma indicada abajo:

PEXYZZ, El formato del material termoplástico código de designación de tubos PE.

Donde: **PE** - significa polietileno

X - es el margen de la densidad característica del compuesto usado para hacer la tubería según lo definido en ASTM D3350

Y - es el margen de la resistencia al crecimiento lento de fisuras característico del compuesto usado para hacer la tubería según lo definido en ASTM D3350

ZZ - es la fatiga hidrostática a largo plazo a 230°F expresado en cientos de PSI

Historically, the market for PE pipe was dominated by essentially two primary thermoplastic material designation codes. These were PE2406 and PE3408. In 2005, changes were made to ASTM D 3350 to allow for the identification and integration of much higher levels of technical performance in PE piping materials within the North American standards system. This resulted in a temporary proliferation of PE thermoplastic piping material designation codes. Today, we still have a fairly broad selection of material designation codes for PE piping systems throughout the marketplace. However, for all practical purposes, the market for PE pipe is characterized by the three common thermoplastics materials designation codes.

PE2708 - This piping product is produced from a medium density compound as defined in the current version of D3350 and is widely used in natural gas distribution and some specialty applications

PE3608 - This piping product is the legacy product resulting from the old PE3408 thermoplastic piping material designation code that was so widely specified and used prior to 2005. It is not uncommon today to see these piping products dual labeled PE3408/PE3608.

PE4710 - This piping product designation represents the culmination of years of technical research on polymer performance in PE piping and offers the designer or end-user exceptional levels of pipe system performance. For example, the PE4710 piping products support a higher long-term hydrostatic stress rating making the pressure rating for a given wall thickness of pipe 25% higher than a comparable PE3608 piping product. By the same token, these piping products exhibit a significantly higher resistance to slow crack growth. Given the exceedingly high technical performance of the PE4710 piping products it is no surprise that they meet or exceed all of the technical requirements of the PE3408 or PE3608 piping products. For this reason is not uncommon to see these piping product dual labeled as PE3408/PE4710 or even triple labeled as PE3408/PE3608/PE4710.

Históricamente, el mercado de la tubería PE estaba dominado esencialmente por dos códigos principales de designación del material termoplástico. Estos eran PE2406 y PE3408. En el 2005, se hicieron cambios al ASTM D 3350 para permitir, dentro del sistema de normas norteamericanas, la identificación e integración de niveles mucho más elevados de desempeño técnico en los materiales de PE. Esto dio como resultado una proliferación provisional de los códigos de designación del material de la tubería termoplástica de PE. Hoy, aún tenemos una muy amplia selección de códigos de designación de material para sistemas de tubería de PE por todo el mercado. Sin embargo, para efectos prácticos, el mercado de la tubería de PE está caracterizado por tres códigos de designación de material termoplástico de uso corriente.

PE2708 - Este producto para tubería es producido a partir de un compuesto de media densidad según lo definido en la versión actual del D3350 y es ampliamente usado en la distribución de gas natural y en algunas aplicaciones especializadas.

PE3608 - Este producto para tubería es un producto heredado y resultado del antiguo código PE3408 de designación del material de la tubería termoplástica que fue ampliamente especificado y usado antes del 2005. No es inusual hoy en día ver estos productos para tubería con doble etiqueta PE3408/PE3608.

PE4710 - Esta designación de producto para tubería representa la culminación de años de investigación técnica en desempeño del polímero en tubería de PE y ofrece al diseñador o al usuario final niveles excepcionales de desempeño de sistemas de tubería. Por ejemplo, los productos PE4710 para tubería soportan un régimen nominal más alto de fatiga hidrostática a largo plazo haciendo que la capacidad de presión para un espesor dado de pared sea 25% más elevada que un producto PE3608 para tubería comparable. De la misma manera, estos productos para tubería exhiben una resistencia significativamente más elevada al crecimiento lento de fisuras. Dado el desempeño técnico sumamente alto de productos PE4710 para tubería no es de sorprenderse que cumplen y exceden todas las exigencias técnicas de los productos PE3408 o PE3608 para tubería. Por esta razón no es inusual ver estos productos de tubería con doble etiqueta como PE3408/PE4710 e incluso con triple etiqueta PE3408/PE3608/PE4710.

Table 1 provides a summary of the different ASTM D 3350 cell classification for each of these materials based on these three primary thermoplastic piping material designation codes.

Table 1: Typical Cell Classification by Current Thermoplastic Piping Material Designation Code

Physical Property	ASTM Test Method	Units	PE2708		PE3608		PE4710	
			Cell Number	Typical Value	Cell Number	Typical Value	Cell Number	Typical Value
Density	D 1505	gr/cc	2	>0.925 - 0.940	3	>0.940 - 0.947	4	>0.947 - 0.955
Melt Index	D 1238	gr/10 min	3	<0.4 - 0.15	4	<0.15	4	<0.15
Flexural Modulus	D 790	psi	3	40,000 - <80,000	5	110,000 - <180,000	5	110,000 - <180,000
Tensile Strength	D 638	psi	3	2,600 - <3,000	4	3,000 - <3,500	4	3,000 - <3,500
Resistance to Slow Crack Growth	F 1473	hours	7	500 minimum	6	100 minimum	7	500 minimum
Hydrostatic Design Basis, HDB	D 2837	psi	3	1250	4	1600	4	1600
UV Stabilizer	D 1603	%	E	Colored with UV Stabilizer	C	2% Min Carbon Black	C	2% Min Carbon Black

Notes:

- The density provided is base resin density (without the influence of carbon black). Typical PE4710 HDPE pipe has a density of 0.956 to 0.964 with carbon black.
- To be designated a PE4710, the pipe resin must meet certain supplementary requirements established by the Stress Board (HSB) of the Plastics Pipe Institute (PPI).

Table 2: ASTM D3350 Chlorine Resistance Testing Categorization

Categorization	Test Stress 2.48 MPa (360 psi) Time (h)	Test Stress 2.76 MPa (400 psi) Time (h)	Test Stress 3.10 MPa (450 psi) Time (h)
CC0	Unspecified	Unspecified	Unspecified
CC1	2700	1900	1900
CC2	7400	5100	3400
CC3	16 200	11 100	7400

It should be noted that other PE thermoplastics piping material designation codes do exist and may be encountered in the market place occasionally. However, the three primary PE thermoplastic piping material designations codes of Table 1 represent the principle PE piping products in the market today. For more information regarding these other thermoplastic piping material designation codes, please contact your ISCO sales professional.

Table 3 below provides a simplification of Table 1 and illustrates the relative ease with which PE piping products may be specified. Using this approach allows the designer or specifier to accurately designate the appropriate PE piping product through the use a single thermoplastic piping material designation code and a relatively simple text string that establishes the physical property requirements for seven key performance properties.

The selected thermoplastic piping material designation code and minimum cell classification is then combined with the appropriate production and installation standards to effectively specify a tough, durable PE piping system. ISCO Industries can provide model specifications for a wide range of PE pipe applications. These model specifications are available at www.isco-pipe.com or by contacting your ISCO sales professional.

Table 3: Representative Minimum Cell Classification by Thermoplastic Piping Material Designation Code

Thermoplastic Piping Material Designation Code	Minimum Cell Classification Per ASTM D3350
PE2708	233373E
PE3608	345464C
PE4710	445474C

La tabla 1 da un resumen de la diferente clasificación de célula según ASTM D 3350 para cada uno de estos materiales basándose en los tres códigos principales de designación del material de la tubería termoplástica.

Tabla 1: Clasificación típica de la célula por el código actual de designación del material de la tubería termoplástica.

Propiedades físicas	Método de prueba ASTM	Unidades	PE2708		PE3608		PE4710	
			Número de célula	Valor típico	Número de célula	Valor típico	Número de célula	Valor típico
Densidad	D 1505	gr/cc	2	>0.925 - 0.940	3	>0.940 - 0.947	4	>0.947 - 0.955
Índice de fundición	D 1238	gr/10 min	3	<0.4 - 0.15	4	<0.15	4	<0.15
Módulo de flexión	D 790	psi	3	40,000 - <80,000	5	110,000 - <180,000	5	110,000 - <180,000
Resistencia a la tracción	D 638	psi	3	2,600 - <3,000	4	3,000 - <3,500	4	3,000 - <3,500
Resistencia al crecimiento lento de fisuras	F 1473	hours	7	500 min	6	100 min	7	500 min
Base del diseño hidrostático, HDB	D 2837	psi	3	1250	4	1600	4	1600
Estabilizador UV	D 1603	%	E	Coloreado con estabilizador UV	C	2% mínimo carbon negro	C	2% mínimo carbon negro

Notas:

1. La densidad provista es la densidad de la resina base (sin la influencia del negro de carbón). La tubería HDPE PE4710 típica tiene una densidad de 0,956 a 0,964 con negro carbón.
2. Para ser designado como un PE4710, la resina del tubo debe cumplir ciertos requisitos suplementarios establecidos por la junta de la fatiga hidrostática (HSB) del instituto de tubería plástica (PPI).

Tabla2: ASTM D3350 Cloro pruebas de resistencia categorización

Categorización	Prueba de esfuerzo 2.48 MPa (360 psi) Tiempo (h)	Prueba de esfuerzo 2.76 MPa (400 psi) Tiempo (h)	Prueba de esfuerzo 3.10 MPa (450 psi) Tiempo (h)
CC0	sin especificar	sin especificar	sin especificar
CC1	2700	1900	1900
CC2	7400	5100	3400
CC3	16 200	11 100	7400

Debe notarse que existen otros códigos de designación para el material de la tubería termoplástica de PE y de cuando en cuando pueden encontrarse en el mercado. Sin embargo, los tres códigos principales de designación del material de la tubería termoplástica de la tabla 1 representan el principio de los productos de la tubería PE en el mercado actual. Para más información referente a estos otros códigos de designación de material termoplástico para tubería, por favor póngase en contacto con profesional de ventas de ISCO.

La tabla 3 de abajo es una simplificación de la tabla 1 e ilustra la relativa facilidad con la cual los productos para tubería PE pueden ser especificados. El uso de esta aproximación permite al diseñador o al que especifica designar con precisión el producto apropiado para tubería PE mediante el uso de un simple código de designación de material de la tubería termoplástica y una cadena de texto relativamente simple que establece los requisitos de las propiedades físicas para siete claves de desempeño.

El código de designación del material de la tubería termoplástica y la clasificación mínima de célula se combinan luego con las normas apropiadas de producción e instalación para especificar eficazmente un sistema de tubería PE fuerte y duradero. ISCO Industries puede proveer especificaciones modelos para una amplia gama de aplicaciones de tubería PE. Estas especificaciones modelo están disponibles en www.isco-pipe.com o al ponerse en contacto con su profesional de ventas de ISCO.

Tabla 3: Representante de Clasificación de la célula mínima por termoplástico tuberías de materiales Código Denominación

Termoplástico tuberías de materiales Código Denominación	Clasificación celular Mínimo Según ASTM D3350
PE2708	233373E
PE3608	345464C
PE4710	445474C

HDPE FITTINGS

Polyethylene Pressure Ratings for Molded and Fabricated Fittings

There are two basic methods of creating most HDPE fittings, either by injection molding or by fabricating from pipe or cylinders. Molded fittings are typically fully pressure rated, since the body of the molded fitting is thicker (extra material around the OD, except at the ends) than the pipe to provide additional strength and maintain the intended pressure rating. Fittings that are typically made by injection molding are 90 degree elbows, 45 degree elbows, tees, reducers, end caps and flange adapters. Molded fittings are typically available in 12" and smaller sizes due to cost and processing reasons.

Fabricated elbows or ells have a reduced pressure rating because the miter cut and weld create an effective diameter change at that point. Stress is increased because of changes in flow direction. The larger the angle of the miter cut, the greater the stress and the greater the need to decrease the pressure rating to maintain an adequate safety factor, typically accepted as 2 to 1.

In the past, a standard 25% derating for HDPE elbows has commonly been used throughout the industry. With the advent of elbows made with larger miter angles (i.e. 3 segment 90/2 segment 45) and new resins, a more systematic approach was needed. The American Society of Mechanical Engineers offers an equation within the process piping code B31.3. In section 304.2, equations 4a and 4b are used to determine pressure ratings of mitered elbows. For HDPE piping, the pressure rating is based on three criteria: the miter angle, the resin's material properties (Pipe Design Stress), and the wall thickness.

The outputs of these equations result in the pressure rating charts that are shown in Table 3 and the margins of the pages of this catalog for each style elbow. In a couple of instances, the listed pressure ratings are 2-3% higher than the calculated values so that, for simplicity in ordering, they will match an existing pressure rating of a pipe with a higher DR (thinner wall). This is justifiable when you consider the majority of pipe comes with an average wall thickness that 3 to 6% greater than the required minimum wall. Also, rarely is a pipe system designed so that it operates consistently at 98% or greater of full pipe pressure rating.

ACCESORIOS HDPE

Capacidades de presión del polietileno para accesorios moldeados o fabricados

Hay dos métodos básicos para elaborar la mayoría de accesorios HDPE, sea mediante moldeo por inyección o por fabricación a partir de tubería o cilindros. Los accesorios moldeados están normalmente categorizados para la presión máxima, ya que el cuerpo del accesorio moldeado es más grueso (material extra alrededor del diámetro externo, excepto en los extremos) que la tubería lo que proporciona una resistencia adicional y mantiene la capacidad de presión esperada. Los accesorios normalmente hechos mediante moldeo por inyección son los codos de 90°, codos de 45°, TES, reductores, tapas de extremo y adaptadores de brida. Los accesorios moldeados están normalmente disponibles en tamaños de 12 pulgadas y más pequeños por razones de costo y de procesamiento.

Los codos o piezas en L fabricados tienen una capacidad de presión reducida debido a que el corte a inglete y la soldadura generan en este punto un cambio en el diámetro efectivo. La fatiga aumenta debido a los cambios en la dirección del flujo. Mientras mayor es el ángulo del corte a inglete mayor es la fatiga y mayor la necesidad de disminuir la capacidad de presión para mantener un factor de seguridad adecuado, normalmente aceptado como 2 a 1.

En el pasado, una reducción estándar del 25% de la capacidad para codos HDPE fue comúnmente usada en toda la industria. Con el advenimiento de codos hechos con ángulos a inglete mayores (por ejemplo 3 segmentos en 90/2 segmentos en 45) y con nuevas resinas, fue necesario hacer un enfoque más sistemático. La Sociedad Americana de Ingenieros Mecánicos ofrece una ecuación en el código de tubería de procesamiento (B31.3) En la sección 304.2, las ecuaciones 4a y 4b son usadas para determinar las capacidades de presión de codos a inglete. Para la tubería HDPE, la capacidad de presión se basa en tres criterios: el ángulo a inglete, las propiedades del material de la resina (fatiga de diseño de la tubería), y el grosor de la pared.

Los resultados de estas ecuaciones dan la capacidad de presión que se muestra en la tabla 3 y en los márgenes de las páginas de este catálogo para cada estilo de codo. En un par de ejemplos, las capacidades de presión listadas son 2-3% más altas que los valores calculados para que, y por simplificar el pedido, se acomodarán con la capacidad de presión existente de una tubería con una DR más alta (pared más delgada). Esto es justificable cuando considera que la mayoría de la tubería viene con un espesor promedio de la pared que es 3-6% mayor que la pared mínima exigida. También, raramente un sistema de tubería es diseñado para que funcione constantemente al 98% o más de la capacidad de presión máxima del tubo.

The standard ISCO warranty applies to all fittings at the listed ratings we publish in this catalog version.

Other fittings such as tees and wyes do not have formulas to account for the pressure ratings. Recently, computer modeling of fittings has served to confirm or contradict historical/legacy rating of fittings. Fabricated tees have typically held a .75 derating factor in the past, but as with elbows, the strength of the fitting is affected by the wall thickness. Tees made from DR 13.5 or thinner have a derating factor of .65. Crosses are of similar form and function, so for DR 11 and thicker crosses, the derating factor will be .5, while thinner walls will have a .4 derating factor. Wyes have had a historical/legacy derating factor in the industry of .6 but computer modeling has confirmed they should be considered much weaker, so a derating factor of .33 has been applied.

DR, PRESSURE RATING, AND AVAILABLE SIZE

In the DR chart, those items listed in blue are standard. Those in gray are considered non-standard and availability may be limited. Those not listed are not available for that fitting style.

La garantía estándar de ISCO se aplica a todos los accesorios en las capacidades listadas que publicamos en esta versión del catálogo.

Otros accesorios como TES Y YES no tienen fórmulas que tengan en cuenta las capacidades de presión. Recientemente, el modelado de los accesorios ha servido para confirmar o contradecir la capacidad histórica/heredada de los accesorios. Las TES fabricadas mantuvieron normalmente una reducción del .75 de la capacidad en el pasado, pero al igual que con los codos, la resistencia del accesorio es afectada por el espesor de la pared. Las TES hechas con una DR del 13.5 o menor están ahora reducidas su capacidad en un .65. Las crues son de forma y función similar, de modo que para piezas en cruz DR11 o más gruesas, el factor de reducción de la capacidad será del .5, mientras que en las de paredes más delgadas será del .4. Las YES, han tenido una reducción histórica/heredada de la capacidad del .6 en la industria, pero la modelización ha confirmado que deberían ser consideradas más débiles, así que ha sido aplicado un factor de reducción de la capacidad del .33.

DR, Presión de servicio y disponible

En el gráfico dr, esos elementos en azul son estándar. Los que están en gris son considerados no-estándar y la disponibilidad pueden ser limitados. Aquellos que no figuran no están disponibles para que el estilo apropiado.

DR	32.5	26	21	17	15.5	13.5	11	9	7
Pressure Rating Resistencia a la Presión	31 psi	41 psi	54 psi	71 psi	81 psi	96 psi	126 psi	164 psi	229 psi

DR	17	11	9	7
Pressure Rating Resistencia a la Presión	71 psi	126 psi	164 psi	229 psi



ISCO IN ACTION

ISCO supplied 13 miles of HDPE to help bring adequate water supply to Navajo Nation in the Southwest.

ISCO suministró 13 millas de tubería HDPE para poder suministrar agua en forma adecuada a la Nación Navajo en el suroeste.

www.isco-pipe.com/Navajo

Table 4: Derating Factors for Fabricating Fittings
For HDPE fittings made from pipe with no additional reinforcement

		Tabla 4: Factores de reducción de capacidad para los accesorios fabricados Para los accesorios de HDPE hechos de tubería sin refuerzo adicional.	
Elbows fabricated with 11.25 mitered cuts	Codos fabricados con cortes a inglete de 11,25 <ul style="list-style-type: none"> Incluyendo curva a inglete a 90° y 5 segmentos, curva a inglete a 45° y 3 segmentos y curva a inglete a 22,5° 	DR	Derating Factor: Reducción de potencia factor
		7	.82
		9	.80
		11	.78
		13.5	.76
		15.5	.75
		17	.74
		21	.72
		26	.69
		32.5	.67
Elbows fabricated with 22.5 mitered cuts	Codos fabricados con cortes a inglete a 22,5° <ul style="list-style-type: none"> Incluyendo curva a inglete a 90° y 3 segmentos y curva a inglete a 45° y 2 segmentos 	DR	Derating Factor: Reducción de potencia factor
		7	.69
		9	.66
		11	.63
		13.5	.60
		15.5	.59
		17	.57
		21	.55
		26	.52
		32.5	.49
Tees-Fabricated	Te Fabricadas	DR	Derating Factor: Reducción de potencia factor
		7, 9, 11	.75
		13.5 - 32.5	.65
Branch Saddle Reducing Tee	TE reductora con silleta ramal	DR	Derating Factor: Reducción de potencia factor
		7 - 32.5	1
Crosses-Fabricated	Cruz – Fabricadas	DR	Derating Factor: Reducción de potencia factor
		7, 9, 11	.60
		13.5 - 32.5	.50
Lateral Wyes-Fabricated	YES laterales - Fabricadas	DR	Derating Factor: Reducción de potencia factor
		7, 9, 11	.33
		13.5 - 32.5	.33
Caps- Fabricated Flat, Non-Molded	Tapas planas- Fabricadas, No moldeadas <ul style="list-style-type: none"> Fully pressure-rated caps are typically available to match pipe in all DR's up to 24". Larger caps may have reduced capacity-verify pressure requirements at time of order. 	DR	Derating Factor: Reducción de potencia factor
		7 - 32.5	*conditional
Plastic Blind Flanges HDPE/PVC	Bridas ciegas plásticas HDPE/PVC <ul style="list-style-type: none"> Blind Flanges are available in 1" thick as standard with limited ranges of full pressure capacity. Some additional thickness options are available. Larger blinds likely have reduced capacity-verify pressure requirements at time of order. 	DR	Derating Factor: Reducción de potencia factor
		7 - 32.5	*conditional
Cleanout Fittings HDPE	Accesorios HDPE de limpieza <ul style="list-style-type: none"> Cleanout Fittings are used in gravity flow applications and are only designed for preventing the intrusion of ambient environment into the pipe. 	DR	Derating Factor: Reducción de potencia factor
		7 - 32.5	0



IPS PIPE AND FITTINGS

IPS

IPS refers to the Iron Pipe Sizing system in use by some industries, including major HDPE pipe manufacturers.

IPS

IPS se refiere al sistema de dimensionamiento de la tubería de hierro usado en algunas industrias, incluidos los principales fabricantes de tubería HDPE.

HDPE PIPE SIZES

IPS PE3608 AND PE4710

Tamaños HDPE tuberías

IPS PE3608 y PE4710

DR		7			7.3			9		
PE3608 Pressure Rating Resistencia a la Presión		267 psi			254 psi			200 psi		
PE4710 Pressure Rating Resistencia a la Presión		333 psi			317 psi			250 psi		
Nom. OD DE Nominal (in)	Actual OD DE Actual (in)	Min Wall Espesor Míni- mo de Pared (in)	Avg ID DI Promedio (in)	Weight Peso (lb/ft)	Min Wall Espesor Míni- mo de Pared (in)	Avg ID DI Promedio (in)	Weight Peso (lb/ft)	Min Wall Espesor Míni- mo de Pared (in)	Avg ID DI Promedio (in)	Weight Peso (lb/ft)
¾	1.05	0.15	0.732	0.19	0.144	0.745	0.18	0.117	0.803	0.15
1	1.32	0.188	0.917	0.291	0.18	0.933	0.281	0.146	1.005	0.235
1¼	1.66	0.237	1.157	0.463	0.227	1.178	0.45	0.184	1.269	0.374
1½	1.9	0.271	1.325	0.607	0.26	1.348	0.59	0.211	1.452	0.49
2	2.38	0.339	1.656	0.95	0.325	1.685	0.92	0.264	1.816	0.77
3	3.5	0.5	2.44	2.06	0.479	2.484	1.99	0.389	2.676	1.664
4	4.5	0.643	3.137	3.402	0.616	3.193	3.29	0.5	3.44	2.751
5	5.375	0.768	3.747	4.85	0.736	3.814	4.68	0.597	4.109	3.92
5	5.563	0.795	3.878	5.2	0.762	3.947	5.022	0.618	4.253	4.204
6	6.625	0.946	4.619	7.374	0.908	4.701	7.13	0.736	5.064	5.963
7	7.125	1.018	4.967	8.49	0.976	5.056	8.23	0.792	5.447	6.89
8	8.625	1.232	6.013	12.498	1.182	6.12	12.07	0.958	6.593	10.11
10	10.75	1.536	7.494	19.416	1.473	7.628	18.75	1.194	8.218	15.7
12	12.75	1.821	8.889	27.312	1.747	9.047	26.38	1.417	9.747	22.085
14	14	2	9.76	32.93	1.918	9.934	31.81	1.556	10.702	26.63
16	16	2.286	11.154	43.01	2.192	11.353	41.55	1.778	12.231	34.78
18	18	2.571	12.549	54.435	2.466	12.773	52.58	2	13.76	44.02
20	20	2.857	13.943	67.203	2.74	14.192	64.91	2.222	15.289	54.342
22	22	3.143	15.337	80.591	3.014	15.611	78.55	2.444	16.818	65.754
24	24	3.429	16.731	95.916	3.288	17.03	93.48	2.667	18.347	78.25
26	26	---	---	---	3.562	18.449	110.769	2.889	19.876	92.535
28	28	---	---	---	---	---	---	3.111	21.404	107.312
30	30	---	---	---	---	---	---	3.333	22.933	123.183
32	32	---	---	---	---	---	---	3.556	24.462	140.183
34	34	---	---	---	---	---	---	3.778	25.991	132.411
36	36	---	---	---	---	---	---	4	27.52	177.399
42	42	---	---	---	---	---	---	---	---	---
48	48	---	---	---	---	---	---	---	---	---
54	54	---	---	---	---	---	---	---	---	---
63	62.99	---	---	---	---	---	---	---	---	---
65	65	---	---	---	---	---	---	---	---	---

- Pressures are based on using water at 23°C (73°F).
- Average inside diameter calculated using actual OD and minimum wall plus 6% for use in estimating fluid flows. Actual ID will vary.
- Other piping sizes or DR's may be available upon request.
- Standard Lengths:
 - 40' for 2"-24"
 - 50' for 26" and larger
 - Coils available for ¾ - 4" (6" by special order)

- Las presiones están basadas en el uso de agua a 23°C (73°F)
- El diámetro interno promedio calculado el diámetro externo real y la pared mínima más 6% para uso la estimación de flujos de fluidos. El diámetro interno real variará.
- Otros tamaños o DR de tubería pueden estar disponibles bajo pedido.
- Longitudes estándar
 - 40 pies para 2-24 pulgadas
 - 50 pies para 26 pulgadas o mayores
 - Bobinas disponibles para ¾ a 6 pulgadas (6 pulgadas para pedidos especiales)

HDPE PIPE SIZES IPS PE3608 AND PE4710

Tamaños HDPE tuberías IPS PE3608 y PE4710

DR		11			13.5			15.5		
PE3608 Pressure Rating Resistencia a la Presión		160 psi			128 psi			110 psi		
PE4710 Pressure Rating Resistencia a la Presión		200 psi			160 psi			138 psi		
Nom. OD DE Nominal (in)	Actual OD DE Actual (in)	Min Wall Espesor Míni- mo de Pared (in)	Avg ID DI Promedio (in)	Weight Peso (lb/ft)	Min Wall Espesor Míni- mo de Pared (in)	Avg ID DI Promedio (in)	Weight Peso (lb/ft)	Min Wall Espesor Míni- mo de Pared (in)	Avg ID DI Promedio (in)	Weight Peso (lb/ft)
¾	1.05	0.095	0.848	0.13	---	---	---	---	---	---
1	1.32	0.12	1.062	0.2	---	---	---	---	---	---
1¼	1.66	0.151	1.34	0.314	---	---	---	---	---	---
1½	1.9	0.173	1.534	0.411	---	---	---	---	---	---
2	2.38	0.216	1.917	0.642	0.176	2.002	0.534	0.153	2.05	0.47
3	3.5	0.318	2.825	1.395	0.259	2.95	1.16	0.226	3.021	1.02
4	4.5	0.409	3.633	2.31	0.333	3.793	1.92	0.29	3.885	1.687
5	5.375	0.489	4.339	3.29	0.398	4.531	2.73	0.347	4.64	2.4
5	5.563	0.506	4.491	3.523	0.412	4.689	2.928	0.359	4.802	2.58
6	6.625	0.602	5.348	5	0.491	5.585	4.152	0.427	5.719	3.656
7	7.125	0.648	5.752	5.78	0.528	6.006	4.8	0.46	6.15	4.21
8	8.625	0.784	6.963	8.47	0.639	7.271	7.04	0.556	7.445	6.197
10	10.75	0.977	8.678	13.16	0.796	9.062	10.932	0.694	9.28	9.626
12	12.75	1.159	10.293	18.51	0.944	10.748	15.38	0.823	11.006	13.53
14	14	1.273	11.302	22.32	1.037	11.801	18.54	0.903	12.085	16.31
16	16	1.455	12.916	29.15	1.185	13.487	24.22	1.032	13.812	21.3
18	18	1.636	14.531	36.89	1.333	15.173	30.651	1.161	15.538	26.95
20	20	1.818	16.145	45.541	1.481	16.859	37.84	1.29	17.265	33.28
22	22	2	17.76	55.105	1.63	18.545	45.79	1.419	18.991	39.712
24	24	2.182	19.375	65.58	1.778	20.231	54.49	1.548	20.717	47.92
26	26	2.364	20.989	77.44	1.926	21.917	64.261	1.677	22.444	56.532
28	28	2.545	22.604	89.785	2.074	23.603	74.522	1.806	24.17	65.563
30	30	2.727	24.218	103.076	2.222	25.289	85.543	1.935	25.897	75.264
32	32	2.909	25.833	117.285	2.37	26.975	97.324	2.065	27.623	85.672
34	34	3.091	27.447	132.411	2.519	28.661	109.905	2.194	29.35	96.714
36	36	3.273	29.062	148.454	2.667	30.347	123.208	2.323	31.076	108.424
42	42	---	---	---	3.111	35.404	167.675	2.71	36.255	147.568
48	48	---	---	---	---	---	---	3.097	41.435	192.774
54	54	---	---	---	---	---	---	3.484	46.614	243.921
63	62.99	---	---	---	---	---	---	---	---	---
65	65	---	---	---	---	---	---	---	---	---

- Pressures are based on using water at 23°C (73°F).
- Average inside diameter calculated using actual OD and minimum wall plus 6% for use in estimating fluid flows. Actual ID will vary.
- Other piping sizes or DR's may be available upon request.
- Standard Lengths:
 - 40' for 2"-24"
 - 50' for 26" and larger
 - Coils available for ¾ - 4" (6" by special order)

- Las presiones están basadas en el uso de agua a 23°C (73°F)
- El diámetro interno promedio calculado el diámetro externo real y la pared mínima más 6% para uso la estimación de flujos de fluidos. El diámetro interno real variará.
- Otros tamaños o DR de tubería pueden estar disponibles bajo pedido.
- Longitudes estándar
 - 40 pies para 2-24 pulgadas
 - 50 pies para 26 pulgadas o mayores
 - Bobinas disponibles para ¾ a 6 pulgadas (8 pulgadas para pedidos especiales)

HDPE PIPE SIZES

IPS PE3608 AND PE4710

Tamaños HDPE tuberías

IPS PE3608 y PE4710

DR		17			19			21		
PE3608 Pressure Rating Resistencia a la Presión		100 psi			89 psi			80 psi		
PE4710 Pressure Rating Resistencia a la Presión		125 psi			111 psi			100 psi		
Nom. OD DE Nominal (in)	Actual OD DE Actual (in)	Min Wall Espesor Míni- mo de Pared (in)	Avg ID DI Promedio (in)	Weight Peso (lb/ft)	Min Wall Espesor Míni- mo de Pared (in)	Avg ID DI Promedio (in)	Weight Peso (lb/ft)	Min Wall Espesor Míni- mo de Pared (in)	Avg ID DI Promedio (in)	Weight Peso (lb/ft)
¾	1.05	---	---	---	---	---	---	---	---	---
1	1.32	---	---	---	---	---	---	---	---	---
1¼	1.66	---	---	---	---	---	---	---	---	---
1½	1.9	---	---	---	---	---	---	---	---	---
2	2.38	0.14	2.079	0.431	---	---	---	---	---	---
3	3.5	0.206	3.064	0.94	---	---	---	---	---	---
4	4.5	0.265	3.939	1.55	0.237	3.998	1.39	0.214	4.046	1.27
5	5.375	0.316	4.705	2.2	0.283	4.775	1.98	0.256	4.832	1.801
5	5.563	0.327	4.869	2.36	0.293	4.942	2.12	0.265	5.001	1.94
6	6.625	0.39	5.799	3.36	0.349	5.886	3.01	0.315	5.956	2.75
7	7.125	0.419	6.236	3.86	0.375	6.33	3.48	0.339	6.406	3.17
8	8.625	0.507	7.549	5.69	0.454	7.663	5.1	0.411	7.754	4.662
10	10.75	0.632	9.409	8.834	0.566	9.551	7.92	0.512	9.665	7.242
12	12.75	0.75	11.16	12.43	0.671	11.327	11.14	0.607	11.463	10.19
14	14	0.824	12.254	14.983	0.737	12.438	13.43	0.667	12.587	12.282
16	16	0.941	14.005	19.57	0.842	14.215	17.54	0.762	14.385	16.042
18	18	1.059	15.755	24.77	0.947	15.992	22.2	0.857	16.183	20.304
20	20	1.176	17.506	30.58	1.053	17.768	27.41	0.952	17.981	25.07
22	22	1.294	19.256	37	1.158	19.545	33.162	1.048	19.779	30.33
24	24	1.412	21.007	44.031	1.263	21.322	39.47	1.143	21.577	36.1
26	26	1.529	22.758	51.856	1.368	23.099	46.701	1.238	23.375	42.486
28	28	1.647	24.508	60.154	1.474	24.876	54.189	1.333	25.173	49.266
30	30	1.765	26.259	69.068	1.579	26.653	62.196	1.429	26.971	56.585
32	32	1.882	28.009	78.557	1.684	28.429	70.755	1.524	28.77	64.37
34	34	2	29.76	88.7	1.789	30.206	79.865	1.619	30.568	72.657
36	36	2.118	31.511	99.457	1.895	31.983	89.571	1.714	32.366	81.446
42	42	2.471	36.762	135.372	2.211	37.314	121.925	2	37.76	110.874
48	48	2.824	42.014	176.813	2.526	42.644	159.198	2.286	43.154	144.833
54	54	3.176	47.266	223.713	2.842	47.975	201.502	2.571	48.549	183.253
63	62.99	3.706	55.143	303.398	3.315	55.97	273.362	3	56.631	249.57
65	65	3.824	56.894	322.967	3.421	57.747	290.994	3.824	58.438	322.967

- Pressures are based on using water at 23°C (73°F).
- Average inside diameter calculated using actual OD and minimum wall plus 6% for use in estimating fluid flows. Actual ID will vary.
- Other piping sizes or DR's may be available upon request.
- Standard Lengths:
 - 40' for 2"-24"
 - 50' for 26" and larger
 - Coils available for ¾ - 4" (6" by special order)

- Las presiones están basadas en el uso de agua a 23°C (73°F)
- El diámetro interno promedio calculado el diámetro externo real y la pared mínima más 6% para uso la estimación de flujos de fluidos. El diámetro interno real variará.
- Otros tamaños o DR de tubería pueden estar disponibles bajo pedido.
- Longitudes estándar
 - 40 pies para 2-24 pulgadas
 - 50 pies para 26 pulgadas o mayores
 - Bobinas disponibles para ¾ a 6 pulgadas (6 pulgadas para pedidos especiales)

HDPE PIPE SIZES IPS PE3608 AND PE4710

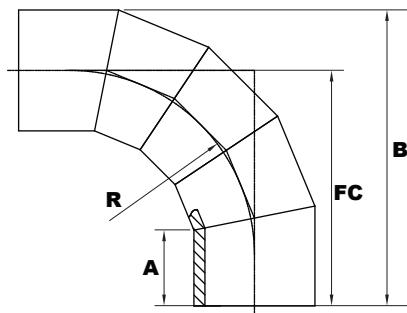
Tamaños HDPE tuberías
IPS PE3608 y PE4710

DR		26			32.5		
PE3608 Pressure Rating Resistencia a la Presión		64 psi			51 psi		
PE4710 Pressure Rating Resistencia a la Presión		80 psi			63 psi		
Nom. OD DE Nominal (in)	Actual OD DE Actual (in)	Min Wall Espesor Míni- mo de Pared (in)	Avg ID DI Promedio (in)	Weight Peso (lb/ft)	Min Wall Espesor Míni- mo de Pared (in)	Avg ID DI Promedio (in)	Weight Peso (lb/ft)
¾	1.05	---	---	---	---	---	---
1	1.32	---	---	---	---	---	---
1¼	1.66	---	---	---	---	---	---
1½	1.9	---	---	---	---	---	---
2	2.38	---	---	---	---	---	---
3	3.5	---	---	---	---	---	---
4	4.5	0.173	4.133	1.035	0.138	4.206	0.835
5	5.375	0.207	4.937	1.47	0.165	5.024	1.19
5	5.563	0.214	5.109	1.582	0.171	5.2	1.28
6	6.625	0.255	6.085	2.25	0.204	6.193	1.811
7	7.125	0.274	6.544	2.582	0.219	6.66	2.083
8	8.625	0.332	7.922	3.8	0.265	8.062	3.07
10	10.75	0.413	9.873	5.91	0.331	10.049	4.77
12	12.75	0.49	11.71	8.312	0.392	11.918	6.71
14	14	0.538	12.858	10.022	0.431	13.087	8.09
16	16	0.615	14.695	13.09	0.492	14.956	10.561
18	18	0.692	16.532	16.57	0.554	16.826	13.37
20	20	0.769	18.369	20.453	0.615	18.695	16.501
22	22	0.846	20.206	24.75	0.677	20.565	19.97
24	24	0.923	22.043	29.452	0.738	22.434	23.762
26	26	1	23.88	34.57	0.8	24.304	27.94
28	28	1.077	25.717	40.187	0.862	26.174	32.421
30	30	1.154	27.554	46.135	0.923	28.043	37.196
32	32	1.231	29.391	52.494	0.985	29.913	42.34
34	34	1.308	31.228	59.264	1.046	31.782	47.773
36	36	1.385	33.065	66.444	1.108	33.652	53.581
42	42	1.615	38.575	90.393	1.292	39.26	72.893
48	48	1.846	44.086	118.082	1.477	44.869	95.233
54	54	2.077	49.597	149.464	1.662	50.478	120.556
63	62.99	2.423	57.854	203.63	1.938	58.881	164.28
65	65	2.5	59.7	216.03	2	60.76	174.29

- Pressures are based on using water at 23°C (73°F).
- Average inside diameter calculated using actual OD and minimum wall plus 6% for use in estimating fluid flows. Actual ID will vary.
- Other piping sizes or DR's may be available upon request.
- Standard Lengths:
 - 40' for 2"-24"
 - 50' for 26" and larger
 - Coils available for ¾ - 4" (6" by special order)
- Las presiones están basadas en el uso de agua a 23°C (73°F)
- El diámetro interno promedio calculado el diámetro externo real y la pared mínima más 6% para uso la estimación de flujos de fluidos. El diámetro interno real variará.
- Otros tamaños o DR de tubería pueden estar disponibles bajo pedido.
- Longitudes estándar
 - 40 pies para 2 -24 pulgadas
 - 50 pies para 26 pulgadas o mayores
 - Bobinas disponibles para ¾ a 6 pulgadas (8 pulgadas para pedidos especiales)

90° ELBOW FABRICATED FIVE-SEGMENT MITERED BEND

Codo De 90° Fabricato De Cinco Segmentos



DR	32.5	26	21	17	15.5	13.5	11	9	7
Pressure Rating Resistencia a la Presión	42 psi	55 psi	72 psi	92 psi	103 psi	126 psi	161 psi	202 psi	274 psi

Nominal Size (in) Tamaño nominal	Actual OD (in) DE Actual	A (in)	B (in)	FC (in)	R (in)
2	2.375	4	15.94	14.75	13.125
3	3.5	4	17	15.25	13.625
4	4.5	5	19.13	16.875	14.25
6	6.625	6	20.19	18.875	15.25
8	8.625	6.5	24.69	20.375	16.25
10	10.75	6.5	26.75	21.375	17.25
12	12.75	8	31.25	24.875	19.5
14	14	8	33.25	26.25	21
16	16	8	36.88	28.875	24
18	18	8	40.38	31.375	27
20	20	8	44	34	30
22	22	8	47.63	36.625	33
24	24	8	51.25	39.25	36
26	26	14	60.88	47.875	39
28	28	14	64.38	50.375	42
30	30	14	68	53	45
32	32	14	71.63	55.625	48
36	36	14	78.88	60.875	54
42	42	21	96.63	75.625	63
48	48	21	107.5	83.5	72
54	54	21	118.25	91.25	81
63	63	21	127.3	95.8	85.5

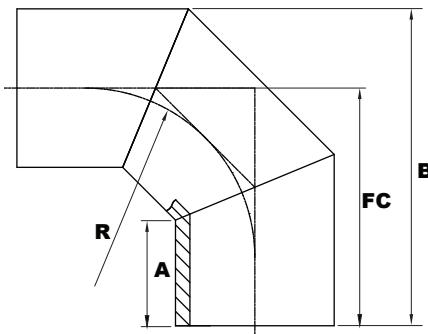
1. Some size/DR combinations may have limited availability.

1. Algunas Tamaño / DR Combinaciones puede tener disponibilidad limitada.

For reference only. Actual dimensions may vary.
Solo para referencia. Las dimensiones reales pueden variar.

90° ELBOW FABRICATED THREE-SEGMENT MITERED BEND

Codo De 90° Fabricado De Tres Segmentos



DR	32.5	26	21	17	15.5	13.5	11	9	7
Pressure Rating Resistencia a la Presión	31 psi	41 psi	54 psi	71 psi	81 psi	96 psi	126 psi	164 psi	229 psi

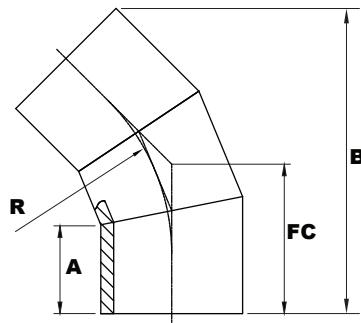
Nominal Size (in) Tamaño nominal	Actual OD (in) DE Actual	A (in)	B (in)	FC (in)	R (in)
2	2.375	4.5	10.06	8.87	6.62
3	3.5	4.5	11.18	9.43	7.18
4	4.5	4.5	12.18	9.93	7.68
6	6.625	5.5	16.01	12.7	9.95
8	8.625	6.5	19.72	15.41	12.16
10	10.75	6.5	21.5	16.13	12.63
12	12.75	8.5	25.5	19.12	13.63
14	14	8.5	26.75	19.75	14.25
16	16	8.5	28.75	20.75	15.25
18	18	8.5	30.75	21.75	16.25
20	20	8.5	32.75	22.75	17.25
22	22	8.5	37.57	26.57	23.07
24	24	8.5	39.57	27.57	24.07
26	26	10	43.9	30.9	26.5
28	28	10	46.5	32.5	28.5
30	30	10	49.1	34.1	30.5
32	32	10	54.9	38.9	38
36	36	10	60.6	42.6	43
42	42	16	75	54	50
48	48	16	83.9	59.9	58
54	54	16	91.7	64.7	64
63	63	18	96.18	64.7	57.4

1. Some size/DR combinations may have limited availability.

1. Algunas Tamaño / DR Combinaciones puede tener disponibilidad limitada.

45° ELBOW FABRICATED THREE-SEGMENT MITERED BEND

Codo De 45° Fabricato De Tres Segmentos



DR	32.5	26	21	17	15.5	13.5	11	9	7
Pressure Rating Resistencia a la Presión	42 psi	55 psi	72 psi	92 psi	103 psi	126 psi	161 psi	202 psi	274 psi

Nominal Size (in) Tamaño nominal	Actual OD (in) DE Actual	A (in)	B (in)	FC (in)	R (in)
2	2.375	4	12.9	7	13.125
3	3.5	4	13.69	7.25	13.625
4	4.5	5	16.11	8.5	14.25
6	6.625	6	19.32	10	15.25
8	8.625	6.5	21.58	10.875	16.25
10	10.75	6.5	23.09	11.25	17.25
12	12.75	8	27.52	13.5	19.5
14	14	8	28.64	13.875	21
16	16	8	30.74	14.75	24
18	18	8	33.08	15.625	27
20	20	8	35.19	16.5	30
22	22	8	37.3	17.25	33
24	24	8	39.4	18.250	36
26	26	14	51.85	25	39
28	28	14	54.09	25.88	42
30	30	14	56.2	26.625	45
32	32	14	58.31	27.5	48
36	36	14	62.52	29.22	54
42	42	21	81.02	38.75	63
48	48	21	87.34	41.25	72
54	54	21	93.9	43.75	81
63	63	21	100.3	45.7	85.5

1. Some size/DR combinations may have limited availability.

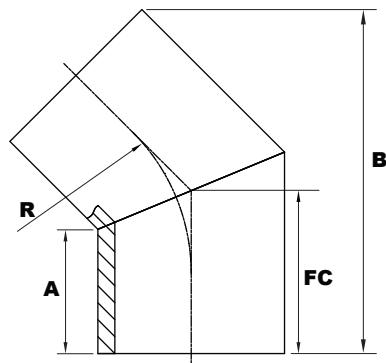
1. Algunas Tamaño / DR Combinaciones puede tener disponibilidad limitada.

For reference only. Actual dimensions may vary.
Solo para referencia. Las dimensiones reales pueden variar.

45° ELBOW FABRICATED TWO-SEGMENT MITERED BEND



Codo De 45° Fabricato De Dos Segmentos



DR	32.5	26	21	17	15.5	13.5	11	9	7
Pressure Rating Resistencia a la Presión	31 psi	41 psi	54 psi	71 psi	81 psi	96 psi	126 psi	164 psi	229 psi

Nominal Size (in) Tamaño nominal	Actual OD (in) DE Actual	A (in)	B (in)	FC (in)	R (in)
2	2.375	4.5	9.36	5	6.62
3	3.5	4.5	10.16	5.25	7.18
4	4.5	4.5	10.86	5.43	7.68
6	6.625	5.5	14.07	6.88	9.95
8	8.625	6.5	17.19	8.25	12.16
10	10.75	6.5	18.7	8.73	12.63
12	12.75	8.5	23.53	11.14	13.63
14	14	8.5	24.41	11.4	14.25
16	16	8.5	25.82	11.81	15.25
18	18	8.5	27.24	12.23	16.25
20	20	8.5	28.65	12.64	17.25
22	22	8.5	30	13.05	23.07
24	24	8.5	31.5	13.5	24.07
26	26	10	35.44	15.4	26.5
28	28	10	36.875	15.8	28.5
30	30	10	38.31	16.2	30.5
32	32	10	39.69	16.6	38
36	36	10	42.5	17.5	43
42	42	16	57	24.7	50
48	48	16	61.25	25.9	58
54	54	16	65.5	27.2	64
63	63	18	75.25	31.06	57.4

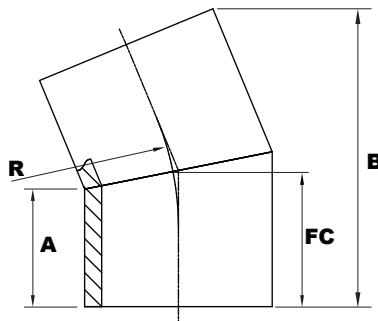
1. Some size/DR combinations may have limited availability.

1. Algunas Tamaño / DR Combinaciones puede tener disponibilidad limitada.

22.5° ELBOW FABRICATED TWO-SEGMENT MITERED BEND



Codo De 22.5° Fabricado De Dos Segmentos



DR	32.5	26	21	17	15.5	13.5	11	9	7
Pressure Rating Resistencia a la Presión	42 psi	55 psi	72 psi	92 psi	103 psi	126 psi	161 psi	202 psi	274 psi

Nominal Size (in) Tamaño nominal	Actual OD (in) DE Actual	A (in)	B (in)	FC (in)	R (in)
2	2.375	4	8.6	4.250	13.125
3	3.5	4	9.03	4.375	13.625
4	4.5	5	11.34	5.5	14.25
6	6.625	6	14.08	6.625	15.25
8	8.625	6.5	15.81	7.375	16.25
10	10.75	6.5	16.62	7.625	17.25
12	12.75	8	20.27	9.25	19.5
14	14	8	20.75	9.375	21
16	16	8	21.51	9.625	24
18	18	8	22.28	9.75	27
20	20	8	23.04	10	30
22	22	8	23.81	10.25	33
24	24	8	24.58	10.375	36
26	26	14	36.88	16.625	39
28	28	14	37.65	16.75	42
30	30	14	38.41	17	45
32	32	14	39.18	17.125	48
36	36	14	40.71	17.625	54
42	42	21	56.47	25.125	63
48	48	21	58.77	25.75	72
54	54	21	61.07	26.375	81
63	63	21	64.5	27.3	85.5

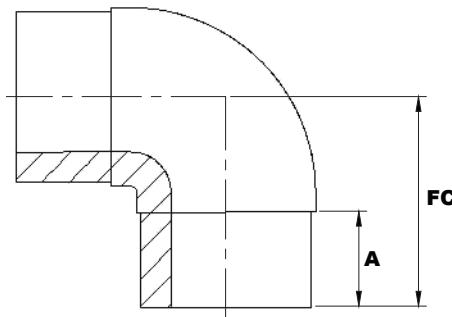
1. Some size/DR combinations may have limited availability.

1. Algunas Tamaño / DR Combinaciones puede tener disponibilidad limitada.

For reference only. Actual dimensions may vary.
Solo para referencia. Las dimensiones reales pueden variar.

90° ELBOW MOLDED

Codo De 90° Moldeado



DR	17	11	9	7
Pressure Rating Resistencia a la Presión	125 psi	200 psi	250 psi	333 psi

Nominal Size (in) Tamaño nominal	A (in)	FC (in)
3/4	2.63	4
1	2.63	4
1 1/4	2.63	4
1 1/2	2.63	4
2	2.81	4.5
3	3	5.13
4	3	5.75
6	4.38	9
8	6	12
10	6	13.25
12	7.5	15.88

- Some size/DR combinations may have limited availability.
- Other DRs available with counter-bored ID at fitting end.

- Algunos Tamaño / DR Combinaciones puede tener disponibilidad limitada.
- Otros proyectos de resolución disponibles con receta aburrido identificación en final apropiado.

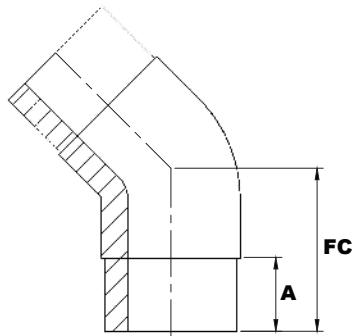


isco IN ACTION

Visit the link below to find out how ISCO provided delivery for fittings, saving the customer from delaying the project for months.

Servicio oportuno para el canal de riego de Utah - haga clic aquí para ver cómo ISCO ofreció entrega para accesorios, ayudando al cliente a no retrasar el proyecto por meses.

www.isco-pipe.com/CanalUT

45° ELBOW
MOLDEDCodo De 45°
Moldeado

DR	17	11	9	7
Pressure Rating Resistencia a la Presión	125 psi	200 psi	250 psi	333 psi

Nominal Size (in) Tamaño nominal	Pipe OD (in) DE Tubo	A (in)	FC (in)
¾	1.05	2.05	2.28
1	1.315	2.17	2.48
1½	1.66	2.44	2.83
2	1.9	2.64	3.07
3	2.375	2.64	3.23
4	3.5	3.13	5
6	4.5	3	5
8	6.625	4.38	7
10	8.625	6	11
12	10.75	6	13.25
	12.75	7.5	15.75

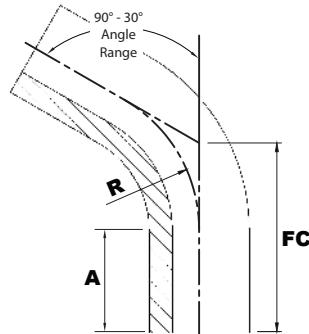
1. Some size/DR combinations may have limited availability.
2. Other DRs available with counter-bored ID at fitting end.

1. Algunos Tamaño / DR Combinaciones puede tener disponibilidad limitada.
2. Otros proyectos de resolución disponibles con receta aburrido identificación en final apropiado.

For reference only. Actual dimensions may vary.
Solo para referencia. Las dimensiones reales pueden variar.

90° - 30° SWEEP BEND

Curva De Barrido 90°- 30°



DR	17	13.5	11	9	7
Pressure Rating Resistencia a la Presión	125 psi	160 psi	200 psi	250 psi	333 psi

Nominal Size (in) Tamaño nominal	Pipe OD (in) DE Tubo	A (in)	90°	60°	45°	30°	R (in)
			FC (in)	FC (in)	FC (in)	FC (in)	
2	2.375	6	13.3	10.5	9	7.5	7.13
3	3.5	6	16.5	12.1	10.3	8.5	10.5
4	4.5	6	19.5	13.8	11.6	9.6	13.5
6	6.625	7	26.9	18.5	15.2	12.3	19.9
8	8.625	10	34.5	24.2	20.1	16.6	24.5
10	10.75	11	43.2	29.6	24.3	19.6	32.25
12	12.75	13	51.3	35.1	28.7	23.3	38.3
14	14	13	51.9	35.5	29.1	23.4	38.9
16	16	16	64	43.7	35.9	28.9	48
18	18	18	72	49.2	40.4	32.5	54
20	20	20	80	54.6	44.9	36.1	60

1. Some size/DR combinations may have limited availability.

1. Algunas Tamaño / DR Combinaciones puede tener disponibilidad limitada.



ISCO IN ACTION

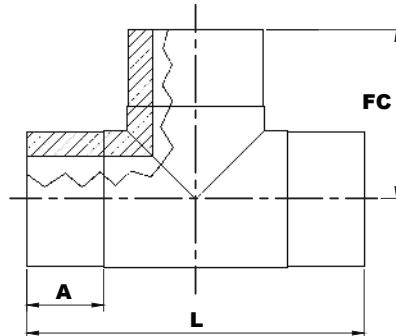
ISCO provided a leak-free HDPE pipeline, replacing open canals and ditches to irrigate the National Elk Refuge near Jackson, Wyoming.

ISCO proporcionó una tubería HDPE sin fugas, sustituyendo los canales y acequias abiertos para regar el Refugio Nacional Elk cerca de Jackson, Wyoming.

www.isco-pipe.com/JacksonWY

TEE
MOLDED

Te Moldeada



DR	17	11	9	7
Pressure Rating Resistencia a la Presión	125 psi	200 psi	250 psi	333 psi

Nominal Size (in) Tamaño nominal	Actual OD (in) DE Actual	A (in)	FC (in)	L (in)
¾	1.05	1.75	3	6.12
1	1.32	1.75	3	6.38
1¼	1.66	1.88	3	6.76
1½	1.90	2.3	4	8.5
2	2.38	2.54	5	9.28
3	3.5	2.9	5	10.26
4	4.5	2.9	6	11.2
6	6.625	4.38	9	18
8	8.625	6	12	24
10	10.75	6	13	26.5
12	12.75	7.5	15.88	31.75

1. Some size/DR combinations may have limited availability.
2. Other DRs available with counter-bored ID at fitting end.

1. Algunos Tamaño / DR Combinaciones puede tener disponibilidad limitada.
2. Otros proyectos de resolución disponibles con receta aburrido identificación en final apropiado.



ISCO IN ACTION

HDPE - the better choice for challenging terrain - visit the link below for more information.

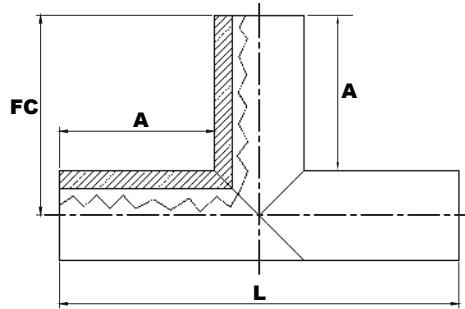
HDPE la mejor opción para terrenos difíciles - haga clic aquí para más información:

www.isco-pipe.com/Guatemala

For reference only. Actual dimensions may vary.
Solo para referencia. Las dimensiones reales pueden variar.

TEE FABRICATED

Te Fabricada



DR	32.5	26	21	17	15.5	13.5	11	9	7
Pressure Rating Resistencia a la Presión	42 psi	53 psi	66 psi	82 psi	90 psi	105 psi	152 psi	189 psi	252 psi

Nominal Size (in) Tamaño nominal	Actual OD (in) DE Actual	A (in)	FC (in)	L (in)
8	8.625	6.5	10.8125	21.625
10	10.75	6.5	11.875	23.75
12	12.75	8	14.375	28.75
14	14	8	15	30
16	16	8	16	32
18	18	10	19	38
20	20	10	20	40
22	22	10	21	42
24	24	10	22	44
26	26	23	36	72
28	28	48	62	124
30	30	46	61	122
32	32	46	62	124
36	36	46	64	128
42	42	42	63	126
48	48	36	60	120
54	54	36	63	126
63	63	36	67.5	135

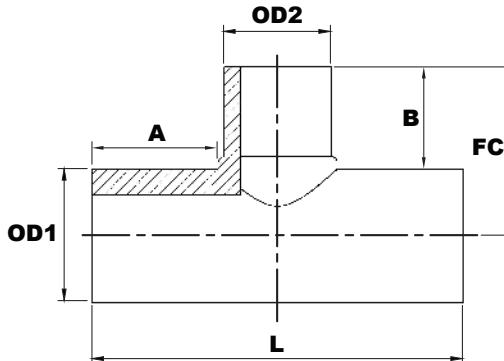
- Some size/DR combinations may have limited availability.
- Thinner DR fittings may not be available in some sizes.

- Algunos Tamaño / DR Combinaciones puede tener disponibilidad limitada.
- Accesorios DR más delgadas pueden no estar disponibles en algunos tamaños

BRANCH SADDLE REDUCING TEE



Te Reductora Con Silla Ramal



DR	32.5	26	21	17	15.5	13.5	11	9	7
Pressure Rating Resistencia a la Presión	63 psi	80 psi	100 psi	125 psi	138 psi	160 psi	200 psi	250 psi	333 psi

Nominal Size (in) Tamaño nominal	OD1 x OD2 (in)	A (in)	B (in)	FC (in)	L (in)
3 x 2	3.5 x 2.375	6.125	5.5	7.25	16
4 x 2	4.5 x 2.375	6.125	5.5	7.75	16
4 x 3	4.5 x 3.5	9.5	4.25	6.5	24
6 x 2	6.625 x 2.375	6.125	5.4375	8.75	16
6 x 3	6.625 x 3.5	9.5	4.1875	7.5	24
6 x 4	6.625 x 4.5	9	5.9375	9.25	24
8 x 2	8.625 x 2.375	6.125	5.4375	9.75	16
8 x 3	8.625 x 3.5	9.5	4.3125	8.625	24
8 x 4	8.625 x 4.5	9	5.9375	10.25	24
8 x 6	8.625 x 6.625	9.813	7.9375	12.25	28
10 x 2	10.75 x 2.375	6.125	5.5	10.875	16
10 x 3	10.75 x 3.5	9.5	4.25	9.625	24
10 x 4	10.75 x 4.5	9	6	11.375	24
10 x 6	10.75 x 6.625	9.813	8	13.375	28
10 x 8	10.75 x 8.625	9.875	8.25	13.625	30
12 x 2	12.75 x 2.375	6.125	5.5	11.875	16
12 x 3	12.75 x 3.5	9.5	4.25	10.625	24
12 x 4	12.75 x 4.5	9	6	12.375	24
12 x 6	12.75 x 6.625	9.813	8	14.375	28
12 x 8	12.75 x 8.625	9.875	8.25	14.625	30
12 x 10	12.75 x 10.75	8.75	6.5	12.875	30
14 x 2	14 x 2.375	6.125	5.5	12.5	16
14 x 3	14 x 3.5	9.5	4.25	11.25	24
14 x 4	14 x 4.5	9	6	13	24
14 x 6	14 x 6.625	9.813	8	15	28
14 x 8	14 x 8.625	9.875	8.25	15.25	30
14 x 10	14 x 10.75	8.75	6.5	13.5	30
16 x 2	16 x 2.375	6.125	5.5	13.5	16
16 x 3	16 x 3.5	9.5	4.25	12.25	24
16 x 4	16 x 4.5	9	6	14	24
16 x 6	16 x 6.625	9.813	8	16	28
16 x 8	16 x 8.625	9.875	8.25	16.25	30
16 x 10	16 x 10.75	8.75	6.5	14.5	30
16 x 12	16 x 12.75	8.6	8.5	16.5	32

Nominal Size (in) Tamaño nominal	OD1 x OD2 (in)	A (in)	B (in)	FC (in)	L (in)
18 x 2	18 x 2.375	6.125	5.5	14.5	16
18 x 3	18 x 3.5	9.5	4.25	13.25	24
18 x 4	18 x 4.5	9	6	15	24
18 x 6	18 x 6.625	9.813	8.25	17.25	30
18 x 8	18 x 8.625	9.875	8.25	17.25	30
18 x 10	18 x 10.75	8.75	6.5	15.5	30
18 x 12	18 x 12.75	8.6	8.5	17.5	32
20 x 6	20 x 6.625	9.81	5.125	15.125	28
20 x 8	20 x 8.625	9.88	7	17	30
20 x 10	20 x 10.75	8.75	6.5	16.5	30
20 x 12	20 x 12.75	8.6	7.5	17.5	32
20 x 16	20 x 16	8.5	15	25	36
22 x 6	22 x 6.625	9.81	5.125	16.125	28
24 x 6	24 x 6.625	9.81	5.125	17.125	28
24 x 8	24 x 8.625	9.88	7	19	30
24 x 10	24 x 10.75	8.75	6.5	18.5	30
24 x 12	24 x 12.75	8.6	7.5	19.5	32
24 x 16	24 x 16	8.5	15	27	36
30 x 6	30 x 6.625	19.81	5.125	20.125	48
30 x 8	30 x 8.625	18.88	7	22	48
30 x 10	30 x 10.75	17.75	6.5	21.5	48
30 x 12	30 x 12.75	16.6	7.5	22.5	48
30 x 16	30 x 16	14.5	15	30	48
32 x 6	32 x 6.625	19.813	5.125	21.125	48
32 x 12	32 x 12.75	16.6	7.5	23.5	48
36 x 6	36 x 6.625	19.813	5.125	23.125	48
36 x 12	36 x 12.75	16.6	7.5	25.5	48
42 x 4	42 x 4.5	21	3.5	24.5	48
42 x 12	42 x 12.75	16.6	7.5	28.5	48
42 x 16	42 x 16	14.8	15	36	48
42 x 18	42 x 18	14.5	15.5	36.5	48
48 x 4	48 x 4.5	21	3.5	27.5	48
48 x 6	48 x 6.625	19.813	5.125	29.125	48

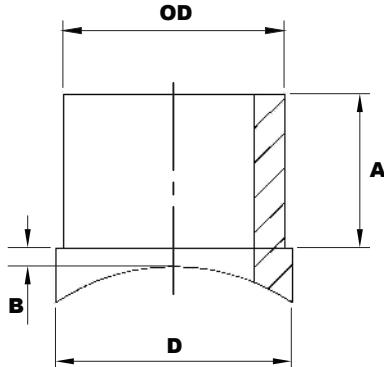
- Some size/DR combinations may have limited availability.
- Thinner DR fittings may not be available in some sizes.

- Algunos Tamaño / DR Combinaciones puede tener disponibilidad limitada
- Accesorios DR más delgadas pueden no estar disponibles en algunos tamaños

For reference only. Actual dimensions may vary.
Solo para referencia. Las dimensiones reales pueden variar.

BRANCH SADDLE

Silleta Ramal



DR	32.5	26	21	17	15.5	13.5	11	9	7
Pressure Rating Resistencia a la Presión	63 psi	80 psi	100 psi	125 psi	138 psi	160 psi	200 psi	250 psi	333 psi

Nominal Size (in) Tamaño nominal	OD (in)	A (in)	B (in)	D (in)
1 1/4	1.66	5.225	.5	2
1 1/2	1.9	6.275	.5	2.45
2	2.375	5.85	.95	2.65
3	3.5	4.875	1	4
4	4.5	4.8	1.5	5
6	6.625	6.625	1.5	7.375
8	8.625	6.575	2	9.25
10	10.75	6	1	11.5
12	12.75	8	1	13.8

1. Any size (IPS/DIPS) main available, but must be larger than outlet size.
2. Hole saws for field cutting coupons are available for purchase.
3. Saddles are typically matched to the DR of the main. Thinner DR outlets may be available. Contact your ISCO representative for availability.

1. Disponible en cualquier tamaño (IPS/DIPS) de tubería principal pero debe ser más grande que el tamaño de la salida.
2. Las sierras de corona para muestras de corte en obra están disponibles para compra.
3. Monturas suelen coincidir con la RD del principal. Salidas DR más delgadas pueden estar disponibles. Póngase en contacto con ISCO para ver la disponibilidad.

NEED FUSION HELP?

ISCO
FUSION HOTLINE
1-800-345-4726 EXT 4790

Call the ISCO Fusion Hotline for fusion troubleshooting from 8AM-8PM Eastern Time.

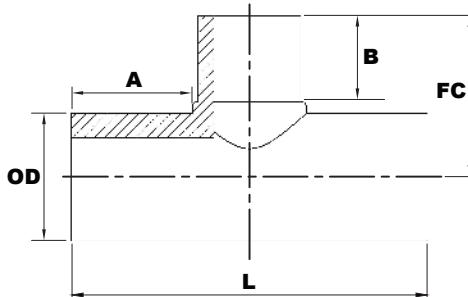
¿Necesita ayuda con la fusión? Llame a la línea directa de fusión de ISCO al 800-345-4726 ext. para solucionar problemas de fusión, de 8 a 8, hora del este.

800-345-4726

REDUCING TEE-MOLDED

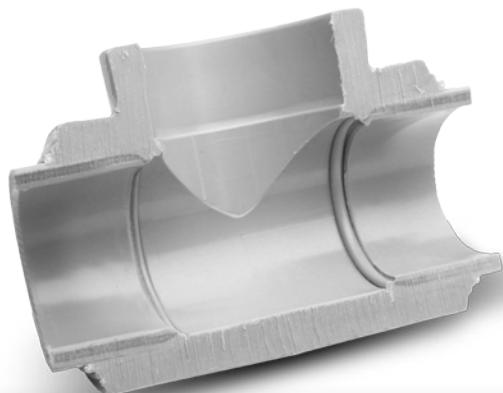


Te Reductora Moldeado



DR	17	11
Pressure Rating Resistencia a la Presión	125 psi	200 psi

Nominal Size (in) Tamaño nominal	17	11	A (in)	C (in)	FC (in)	L (in)
	OD (in)	OD (in)				
3 x 2	3.62	3.5	3.62	2.48	5.9	11.8
4 x 2	3.94	4.5	3.94	2.48	6.89	13.78
4 x 3	3.94	4.5	3.94	3.62	6.89	13.78
6 x 2	4.72	6.63	4.72	2.48	9.06	18.1
6 x 3	4.72	6.63	4.72	3.62	9.06	18.1
6 x 4	4.72	6.63	4.72	3.94	9.06	18.1
8 x 2	5.71	8.63	5.71	2.48	11.8	23.6
8 x 3	5.71	8.63	5.71	3.62	11.8	23.6
8 x 4	5.71	8.63	5.71	3.94	11.8	23.6
8 x 6	5.71	8.63	5.71	4.72	11.8	23.6
10 x 4	6.3	10.75	6.3	3.94	13.78	27.4
10 x 6	6.3	10.75	6.3	4.72	13.78	27.4
10 x 8	6.3	10.75	6.3	5.71	13.78	27.4
12 x 6	7.48	12.75	7.48	4.72	15.95	31.4
12 x 8	7.48	12.75	7.48	5.71	15.95	31.4
12 x 10	7.48	12.75	7.48	6.3	15.95	31.4



COST SAVINGS

ISCO PP-RCT reduces thermal expansion by up to 70 percent, reducing the number of expansion loops, elbow offsets, and expansion joints.

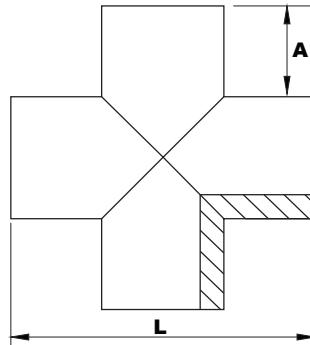
AHORRO DE COSTOS: ISCO PP-RCT reduce la expansión térmica hasta en un 70 por ciento, lo que reduce el número de bucles de expansión, las compensaciones de codo, y las juntas de expansión.

www.isco-pipe.com/PPRCT

For reference only. Actual dimensions may vary.
Solo para referencia. Las dimensiones reales pueden variar.

CROSS FABRICATED

Cruz Fabricada



DR	17	11	9	7
Pressure Rating Resistencia a la Presión	50 psi	81 psi	101 psi	134 psi

Nominal Size (in) Tamaño nominal	Actual OD (in) DE Actual	A (in)	L (in)
2	2.375	3.4525	9.28
3	3.5	3.38	10.26
4	4.5	3.35	11.2
6	6.625	5.6875	18
8	8.625	7.6875	24
10	10.75	6.5	23.75
12	12.75	8	28.75
14	14	8	30
16	16	8	32
18	18	10	38
20	20	10	40
22	22	10	42
24	24	10	44
28	28	48	124
30	30	46	122
32	32	46	124
36	36	46	128

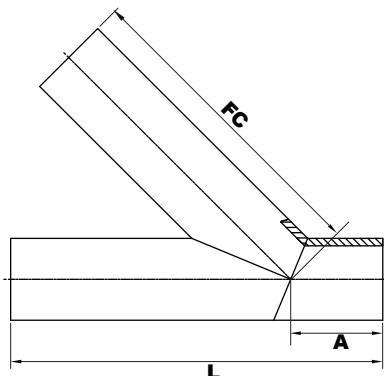
- Some size/DR combinations may have limited availability.
- Thinner DR fittings may not be available in some sizes.
- Dimensions can be reduced for shipping purposes. Fusion equipment and methods should be considered.

- Algunos Tamaño / DR Combinaciones puede tener disponibilidad limitada.
- Accesorios DR más delgadas pueden no estar disponibles en algunos tamaños
- Dimensiones pueden reducirse por razones de envío. Equipos y métodos de fusión deben ser considerados.

45° LATERAL WYE FABRICATED



Yos Laterales 45° Fabricadas



DR	17	11	9	7
Pressure Rating Resistencia a la Presión	42 psi	67 psi	84 psi	112 psi

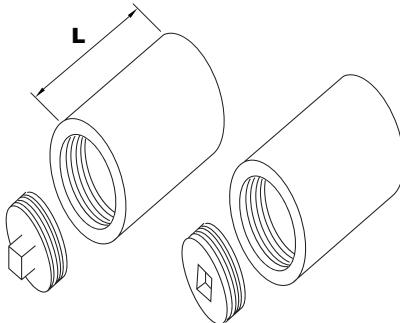
Nominal Size (in) Tamaño nominal	Actual OD (in) DE Actual	A (in)	FC (in)	L (in)
2	2.375	6.3125	18	25
3	3.5	7.5	19.4375	25
4	4.5	6.8125	20.4375	26.5
6	6.625	7.75	29.25	35.5
8	8.625	9.6875	32.1875	40
10	10.75	10.125	37.25	50.5
12	12.75	10.5625	38.0625	54.6
14	14	18.875	50.875	64
16	16	22.3125	57.3125	73
18	18	22.75	57.75	73
20	20	26.125	91.125	109
22	22	26.5625	91.5625	109
24	24	27	92	109

1. Some size/DR combinations may have limited availability.
2. Thinner DR fittings may not be available in some sizes.

1. Algunos Tamaño / DR Combinaciones puede tener disponibilidad limitada.
2. Accesorios DR más delgadas pueden no estar disponibles en algunos tamaños

CLEAN OUT THREADED

Tapa De Limpieza



Nominal Size (in) Tamaño nominal	Actual OD (in) DE Actual	L (in)
2	2.375	6
3	3.5	6
4	4.5	6
6	6.625	6
8	8.625	6
10	10.75	6
12	12.75	6

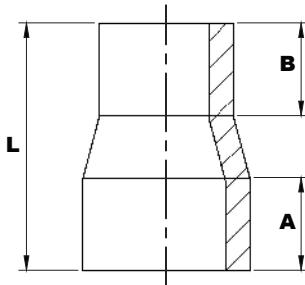
1. Clean Out fittings are rated for gravity service only.
2. Male boss standard. Female boss available upon request.
3. Fusion end of fitting comes standard as DR11 wall thickness.

1. Los accesorios de limpieza están clasificados solo para servicios por gravedad.
2. Norma jefe masculino, jefa disponibles bajo petición.

AWARD-WINNING: For three years in a row, Plastics Pipe Institute has given an ISCO project their "Project of the Year" award. See the work that took home the prize year after year.

RECONOCIMIENTO: La organización Plastic Pipe Institute (PPI) ha otorgado el premio "Proyecto del Año" a ISCO en tres ocasiones consecutivas. Vea los detalles de los proyectos ganadores en la página web www.isco-pipe.com/PPIAward

CONCENTRIC REDUCER

Reducer
Concéntrico

DR	32.5	26	21	17	15.5	13.5	11	9	7
Pressure Rating Resistencia a la Presión	63 psi	80 psi	100 psi	125 psi	138 psi	160 psi	200 psi	250 psi	333 psi

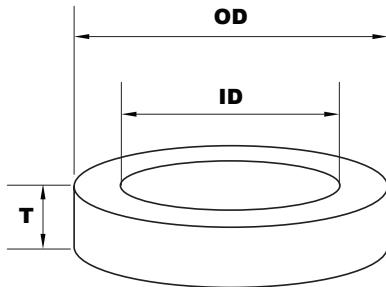
Nominal Size (in) Tamaño nominal	A (in)	B (in)	L (in)
1 x ½	1.5	1.25	4
1 x ¾	1.5	1.75	4.5
1¼ x 1	1.86	1.92	4.25
1½ x ¾	2.5	2.4	5.69
1½ x 1	2.5	2.28	5.75
1½ x 1¼	1.88	2	4
2 x ¾	3.25	1.25	6.25
2 x 1	2.49	2.88	6.31
2 x 1¼	3.15	2.56	6.44
2 x 1½	2.5	2.72	6
3 x 2	3.22	2.5	6.65
4 x 2	3	3	11.87
4 x 3	3.13	3.13	8.62
5 x 4	1.75	1.25	3.75
6 x 3	5.12	3.94	11.42
6 x 4	4.22	3.75	9.13
6 x 5	4.8	4.15	11.2
8 x 4	4.65	3.55	11.425
8 x 6	5	4.64	10.7
10 x 6	6	6	12
10 x 8	6.63	6.25	14.98
12 x 8	6	6	16
12 x 10	6.63	6.25	14.88
14 x 10	7	7	14

Nominal Size (in) Tamaño nominal	A (in)	B (in)	L (in)
14 x 12	7	7	18
16 x 12	7	7	14
16 x 14	7	7	18
18 x 12	8	8	19
18 x 14	7	7	14
18 x 16	7	7	18
20 x 18	7	7	14
22 x 20	8	8	20
24 x 18	8	8	19
24 x 20	9	9	18
24 x 22	8	8	17
26 x 24	8	8	17
28 x 26	8	8	17
30 x 24	8	8	18
30 x 28	8	8	19
32 x 30	8	8	17
34 x 32	8	8	17
36 x 30	8	8	19
36 x 32	8	8	18
36 x 34	8	8	17
42 x 36	10	10	23
48 x 42	16.5	16.5	36
54 x 48	16.5	16.5	36
63 x 54	16.5	16.5	37.5

VALVE SPACER



Espaciador De Válvula



Nominal Size (in) Tamaño nominal	OD (in)	ID (in)	T (in)
2	3.5	2.8	2
3	4.8	3.6	2
4	6.625	5.15	2
6	8.625	6.625	2
8	10.75	8.625	2
10	13	10.75	2
12	15.25	12.45	2
14	17.5	14	2
16	20	16	2
18	21.1	17.25	2
20	23.5	19.25	2
22	25.6	22.4	2
24	28	22.75	3

1. Larger sizes available as non-standard offering. Dimensions based on actual valve and flange combinations. Check with your ISCO technical representative for pressure requirements above 160 psi.

1. Tamaños más grandes disponibles como oferta no estándar. Dimensiones en base a combinaciones de válvulas y bridas reales. Consulte con su representante de la ISCO para los requisitos de calificación de presión por encima de 160 psi.



iSCO IN ACTION

HDPE offers economic benefits and construction advantages that other pipe materials cannot match. That's why a Dalton, Georgia utility company relied on ISCO to upgrade potable and wastewater systems.

La tubería HDPE ofrece beneficios económicos y ventajas de construcción que otros materiales de tuberías no pueden igualar. Es por esto que una empresa de servicios públicos de Dalton, Georgia, confió en ISCO para actualizar sus acueductos de agua potable y aguas residuales.

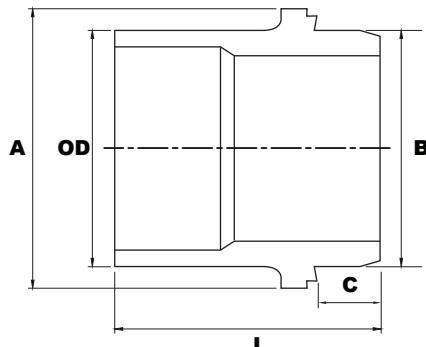
www.isco-pipe.com/DaltonGA

MJ (MECHANICAL JOINT) ADAPTER



DR	17	11	9
Pressure Rating Resistencia a la Presión	125 psi	200 psi	250 psi

Juego Adaptador De La Unión Mecánica (UM)



Nominal Size (in) Tamaño nominal	OD (in)	A (in)	B (in)	C (in)	L (in)
3	3.5	5.43	3.96	1.75	8.5
4	4.5	6.6	4.8	1.75	9.75
6	6.625	8.43	6.9	1.75	10.81
8	8.625	10.54	9.05	1.75	11.5
10	10.75	12.83	11.1	1.75	13.1
12	12.75	14.85	13.2	1.75	12.5
14	14	17.5	15.3	2.25	13.5
16	16	20	17.4	2.25	14.5
18	18	22	19.5	2.25	16
20	20	24	21.6	2.25	16.5
24	24	28	25.8	2.25	18

1. MJ Adapter Kit available with or without stainless steel insert stiffener. Dimensions shown are for MJ Adapter with stiffener and dimensions for MJ Adapter without stiffener may vary.

1. El kit disponible con o sin refuerzo inserto de acero inoxidable. Las dimensiones indicadas son para UM con refuerzo y las dimensiones de la UM y sin refuerzo puede variar.



MJ ADAPTER KIT Sold Separately

Kit Includes:

- Gasket
- T-Bolts and Nuts
- Metal Gland:
 - Included in 12-inch and smaller sizes, available as C110 (heavyweight) or C153 (lightweight)
 - C110 Metal Gland Sold separately for 14-inch and larger.

UM Adaptador Equipo (Se vende por separado)

Incluye:

- junta
- T-tornillo y tuerca
- Glándula de metal:
 - Incluido en 12 pulgadas y tamaños más pequeños, disponible como C110 (peso pesado) del C153 (ligero)
 - Glándula C110 metal se vende por separado por 14 pulgadas y más grandes.